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PETROLEUM, PAST, PRESENT AND FUTURE[1]

By Dr. PER K. FROLICH

ESSO LABORATORIES, STANDARD OIL DEVELOPMENT COMPANY, ELIZABETH, N. J.

Synopsis: This paper reviews the recent remarkable progress in the petroleum field. Our growing dependence on the products of the oil industry has resulted in considerable concern regarding the ability to supply our future needs for liquid hydrocarbons. The proved reserves of crude oil correspond to some fifteen years' consumption at the prewar rate. However, the excessive wartime requirements for petroleum have led to such a high rate of withdrawal from these underground reservoirs that we may not be able to keep up with the demand for long. In addition to the proved reserves of petroleum known to be present in the earth, large but as yet undiscovered petroleum resources may be expected to exist in various parts of the world. How long we can continue to find this oil and bring it to the surface at the desired rate is a question, but it is certain that eventually a shortage in natural petroleum will occur. When that time comes, it should be possible to supply our needs for gasoline and other hydrocarbon products from such alternate sources as natural gas, shale oil and coal. It is concluded that there need be no sudden change as far as the supply and consumption of gasoline and other petroleum derivatives are concerned. Future developments in this field will probably be characterized by further technological progress, increased drilling for oil on a world-wide basis, necessary adjustments in supply and demand, and a gradual shift to synthetically produced hydrocarbons.

[1] Presented before the general meeting at the 106th meeting of the American Chemical Society, Pittsburgh, Pa., and printed in the November issue of *Industrial and Engineering Chemistry*. Unless stated otherwise, the charts shown are based on data from the Bureau of Mines and other Government agencies, "Petroleum Facts and Figures" (1941 and previous editions), and on petroleum industry figures.

A GREAT deal of attention is currently being devoted to the petroleum situation. Until a short while ago we were primarily concerned with the transportation problem. The question of getting available petroleum

products to where they were needed seemed to overshadow all other considerations. Now that the transportation difficulties gradually are being overcome, our interest is turning to the question of the country's ability to produce crude oil to supply the present and future demands for petroleum products.

Our industrialized civilization is fundamentally based on the utilization of mineral resources. It is therefore not surprising that, in the forty-year period of industrial expansion in this country, the world's mineral production has been greater than in all preceding history.[2] In the United States petroleum and its by-products in terms of dollar value account for 40 per cent. of the total mineral production.[3] Half of the crude oil used to date in this country has been taken out of the ground in the last twelve years.

The importance of petroleum in relation to other available sources of energy is brought out by Fig. 1;

U. S. ENERGY SOURCES

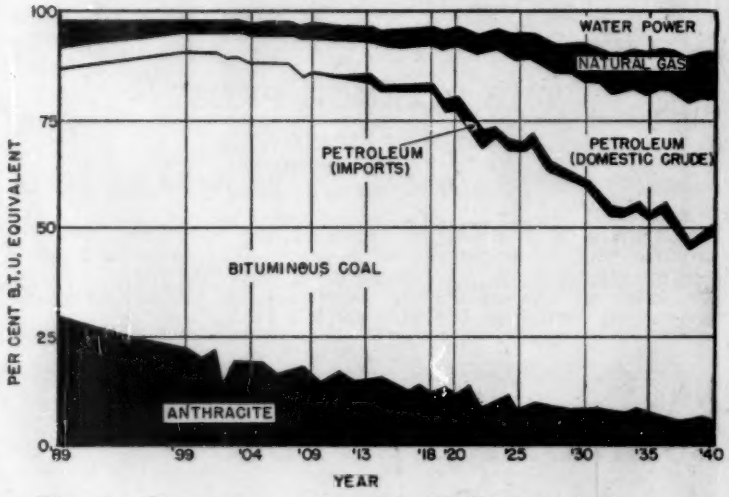

FIG. 1. Percentage of total B.T.U. equivalent contributed by the several sources of energy, counting water power at constant fuel equivalent, 1889–1940. If water power is counted at the prevailing fuel equivalent of central stations in each year, its proportion is 3.2 per cent. in 1899 and 3.5 in 1940, and the proportions of other sources of energy are affected accordingly (reproduced from Bureau of Mines Minerals Year Book Review of 1940, page 776).

it is seen that some 40 per cent. of our energy (B. t. u. equivalence basis) comes from crude oil and natural gas. A peak of 43.5 per cent. was actually reached in 1938. Some of the remarkable growth indicated for this energy source represents a shift from coal, but most of the gain in the recent twenty-year period is due to the development of new forms of transportation based on the use of liquid fuels.

This trend toward motorized transportation has not only been responsible for a greatly increased produc-

[2] C. K. Leith, J. W. Furness and C. Lewis, "World Minerals and World Peace," Washington, Brookings Institution, 1943.

[3] "Petroleum Facts and Figures," 7th ed., New York, American Petroleum Institute, 1941.

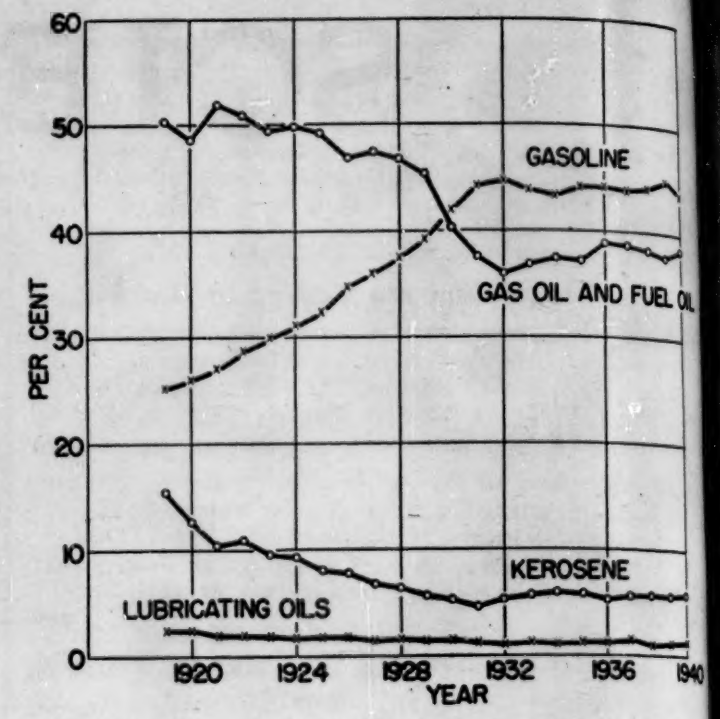

FIG. 2. Average yield of principal petroleum products per barrel of crude oil produced.

tion of crude oil, but has also resulted in the conversion of a gradually increasing proportion of the crude into gasoline. According to Fig. 2, the yield of gasoline on crude increased from 25 per cent. in 1919 to some 45 per cent. in 1932. How the technological developments in cracking made this rise possible is so well known to chemists that it requires no further discussion.

That the average gasoline yield has leveled off in the 43–45 per cent. region during recent years is purely a matter of relative demand for the various products from petroleum. From a technological standpoint there is nothing to prevent it from going higher. In-

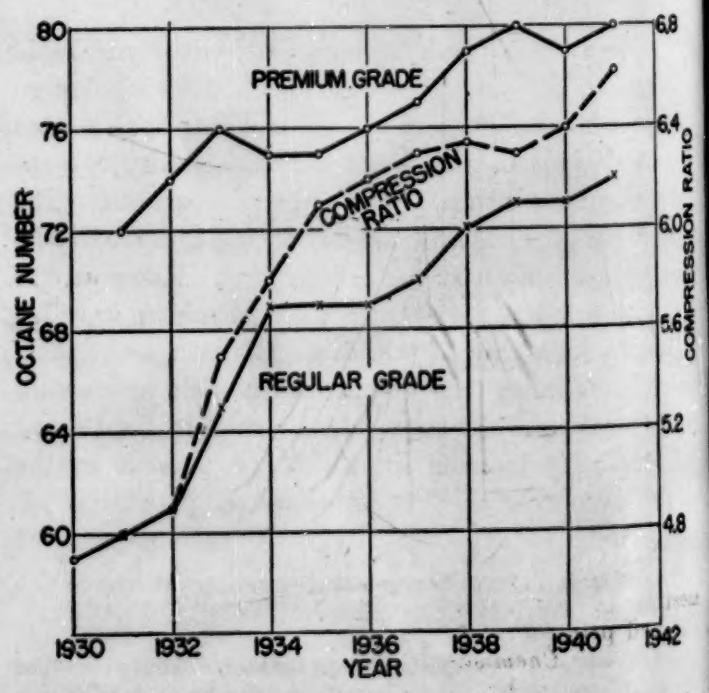

FIG. 3. Trends in octane ratings of gasolines and in compression ratios of automobile engines.

need, it is entirely feasible by catalytic cracking under high pressure of hydrogen to convert crude oil to gasoline, volume for volume.

Along with the increase in yield of gasoline there has also been a marked improvement in quality. One of the important factors as far as quality of motor fuel is concerned is octane number. The progressive increase in octane rating shown in Fig. 3 may be taken as evidence of the petroleum industry's ability to control the chemical composition of its fuels; it can also be seen from this figure that the improvement in octane number, by and large, parallels the engine builder's increase of compression ratio, which in turn is a criterion of the power output that can be obtained per unit of fuel.

As a result of the progress made by both the petroleum and automotive industries, the American public has become increasingly dependent upon motorized transportation. Fig. 4 shows the growth in number

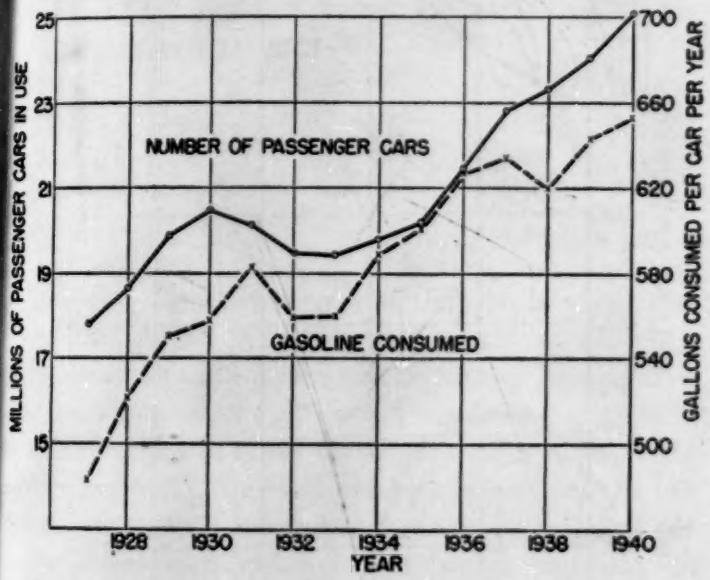

FIG. 4. Passenger cars in use in the United States and their consumption of gasoline.

of passenger cars registered, as well as in the average gasoline consumption per car. The depression of the thirties brought home to all of us how dependent modern society has become upon the automobile. It was frequently stated then that the last thing the average man was willing to give up was his private means of transportation. The family car stood out as ranking with shelter, food and clothing as a necessity of life. Many were the instances related in which the car seemed to head the list. This situation is brought out in Fig. 4, which shows an inconceivably small sacrifice in automobile use during the depression. It should be noted that these data concern passenger cars only. Had busses and trucks been included, the resulting curves for total car registration and average fuel consumption would have shown almost imperceptible dips. This record of the past leaves no doubt that the American public has a live interest in the future of petroleum.

It is not only motorized transportation, however, that is dependent upon an adequate supply of petroleum. During the recent period of expanded crude oil production, our entire mode of living has become geared to the use of petroleum products. Industry, agriculture and shipping alike are large consumers of a multitude of hydrocarbon materials derived from petroleum sources. The list includes such varied products as industrial and process oils, greases and extreme pressure lubricants, asphalts and road oils, solvents and insecticides, and an ever-increasing number of chemical raw materials and derivatives. The petroleum chemicals business, which already had contributed a considerable volume of various alcohols and related products, has recently been called upon to increase several fold the country's supply of toluene for explosives and to furnish two thirds of the butadiene

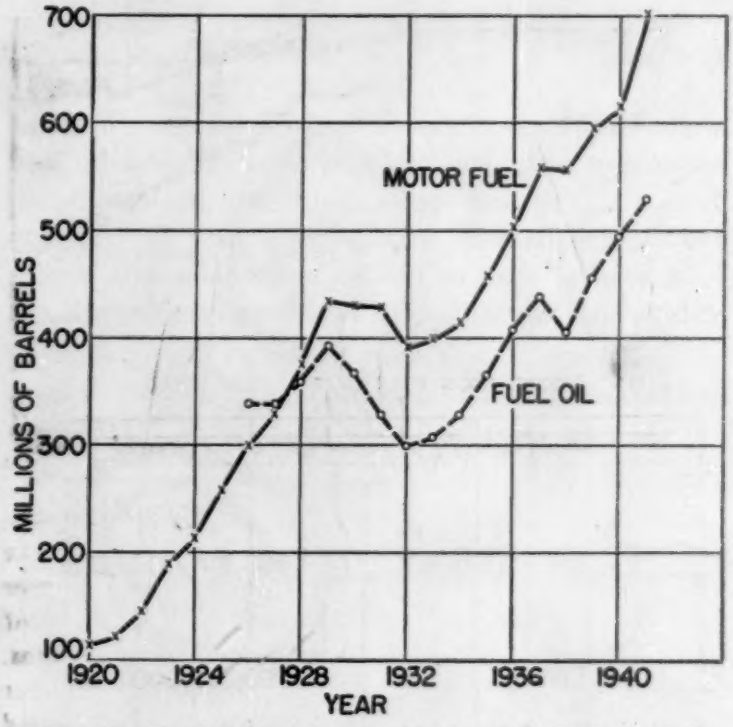

FIG. 5. Production of motor fuel and fuel oil (includes Diesel and other gas oil and distillates, and residual fuel oil, but not kerosene).

for the synthetic rubber program. According to Ickes[4] the production of toluene from petroleum will, by the end of the current year, be nearly six times that obtained from all by-product operations.

The four main classes of products shown in Fig. 2 add up to account for some 90 per cent. of the materials derived from crude oil. The group of products included in the classification "fuel oil" rank next to gasoline in volume. The growth in fuel oil production is illustrated in Fig. 5. Heating oil accounts for some 25 per cent. of the total fuel oil consumption;

[4] H. L. Ickes, "Fightin' Oil," New York, Alfred A. Knopf, 1943.

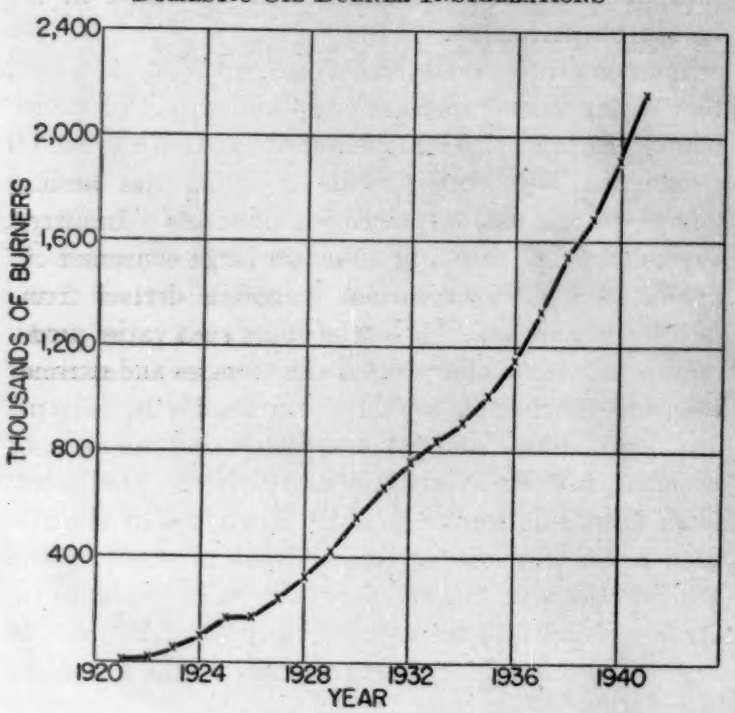

FIG. 6. Domestic oil burners installed at beginning of each year.

about two thirds of this is used for homes. How this outlet for petroleum has developed can best be seen from Fig. 6, which shows the growth in domestic oil burner installations. Although it may be easier to heat a house than to run an automobile with a substitute fuel, the millions of American families who are dependent upon petroleum for heating can also be counted on to have a genuine interest in the future of our oil supplies.

The position of the United States as a producer of crude oil is shown by Fig. 7. The data indicate that prior to the war we supplied some 63 per cent. of the world's petroleum requirements. At present the figure is higher. Although considerable crude from other sources is normally worked up in American-owned refineries located outside the United States, our actual import and export of crude are small in comparison with domestic production (Fig. 8). The volume of refined products imported has been about equal to that of the crude oil import, while the export of refined products has been running 20–40 per cent. higher than

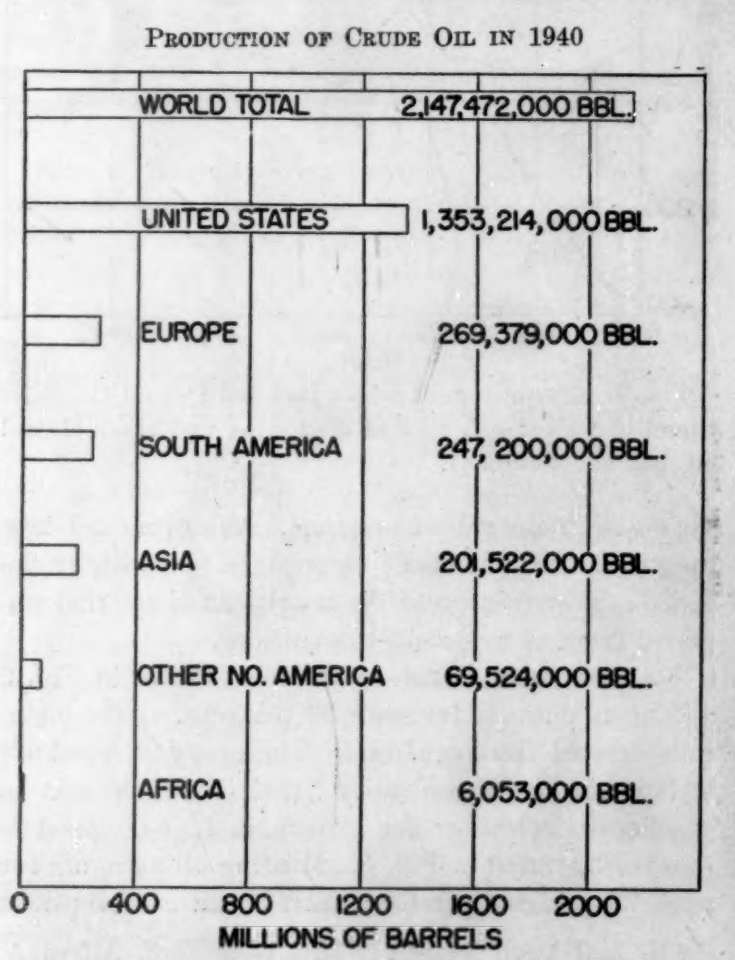

FIG. 7. Production of crude oil in 1940.

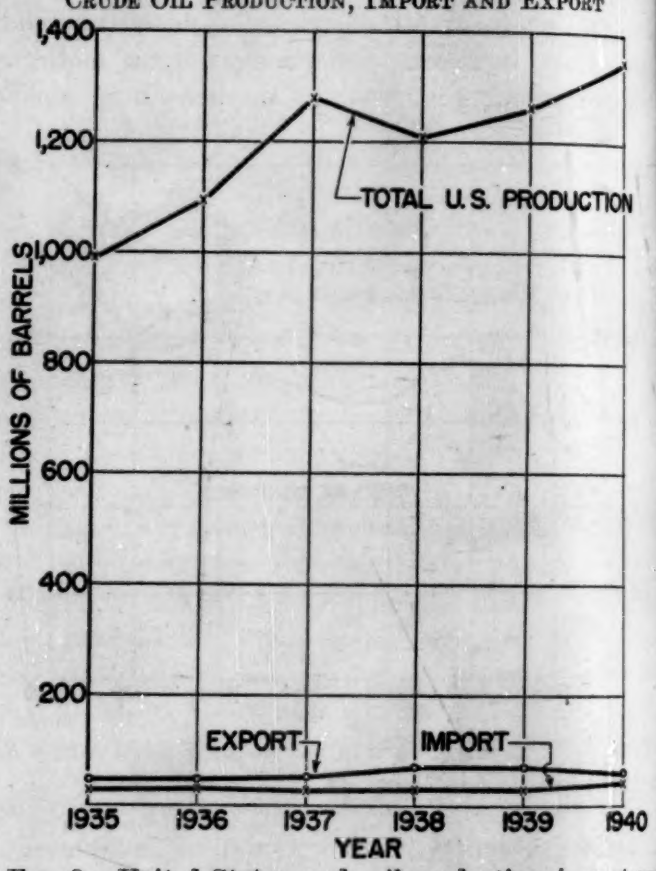

FIG. 8. United States crude oil production, import and export.

the figures for crude export during the period covered by Fig. 8. In other words, the United States production of crude oil has been in rather close balance with domestic requirements of petroleum products.

Fig. 9 gives the production and refining of petroleum by states. It is evident that there is considerable flexibility as far as the location of these two branches of the industry is concerned. Due to the ease with which crude oil can be transported by pipe line, tanker, barge and rail, the refining operations are not tied down to the place of production but can be carried out at points most suitable from the standpoint of distribution and/or consumption of the finished products.

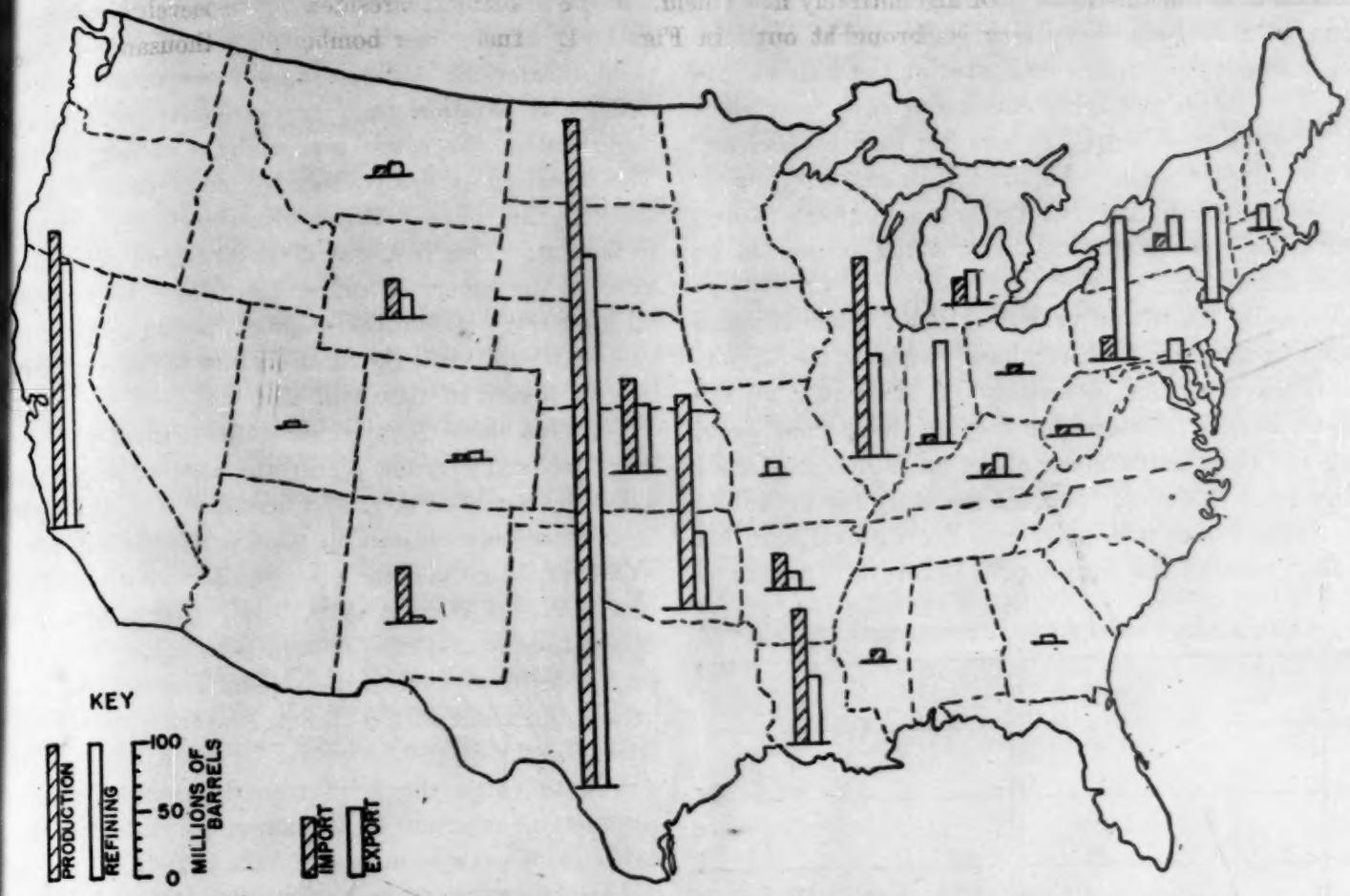

FIG. 9. Production and refining of petroleum by states.

The rate at which crude oil has been withdrawn from the ground is shown in Fig. 10 by the curve labeled "cumulative production." On the "cumulative, discovery" curve, the somewhat scattered points indicate the estimates made by various authorities at the time indicated. The vertical distance between the two curves represents the "proved reserves" at any one time. These are the oil reserves which, according to best estimates, are known to exist in the ground. As of July 1 of this year, the known and untapped reserves amounted to 20.4 billion barrels,[4a] or sufficient for perhaps fifteen years of our normal requirements. The proved reserves outside the United States are slightly greater, about 22 billion barrels. Of this oil located in other parts of the world, Britain controls about 50 per cent., America 25 to 30 per cent. and Russia around 20 per cent.[5]

The data in Fig. 10 show that, except for a period in the twenties when a shortage was seriously feared, the proved reserves have always kept ahead of production by a rather comfortable margin. However, only part of the growth in reserves shown is due to discovery of new fields; the remainder is made up of extensions to existing fields. As a new field is being developed by the drilling of additional wells, information is obtained which may lead to an upward revision of the originally estimated volume of oil present. This is what is meant by an extension to an existing field in

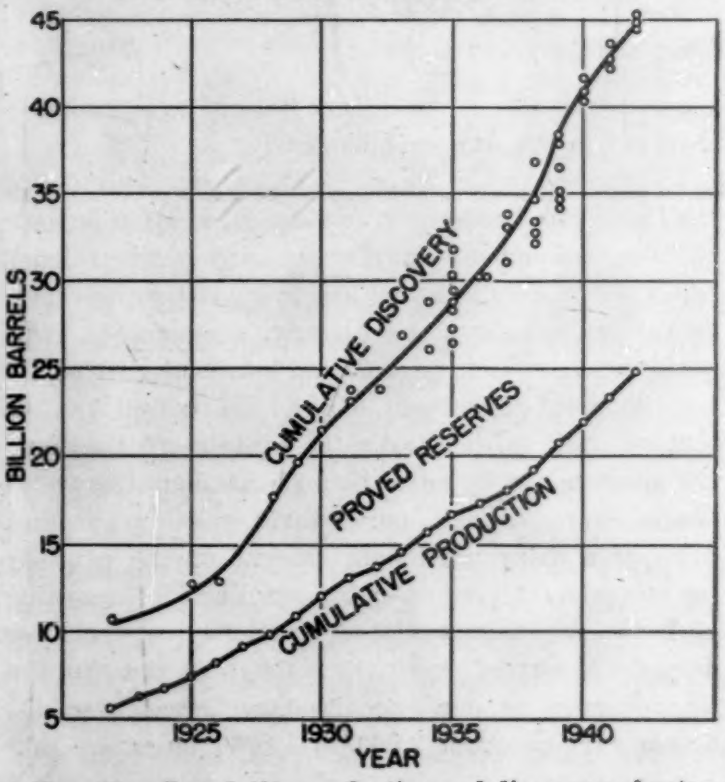

FIG. 10. Cumulative production and discovery of petroleum in the United States, adapted from Levorsen's data (*World Petroleum*, November, 37, 1942).

[4a] W. V. Howard, *Oil Gas Jour.*, July 28, 90, 1943.
[5] W. E. Pratt, "Oil in the Earth," Lawrence, Kans., University of Kansas Press, 1942.

contrast to the discovery of an entirely new field. The trend of actual discovery is brought out in Fig. 11, which shows the present estimates of the ultimate recoverable oil in the fields discovered each year since 1918. It is apparent that there has been a deficiency in new discoveries as compared with consumption of crude since 1939. It is this lag in the discovery of new petroleum reservoirs which now is the subject of so much discussion.

Normally the fifteen-year backlog of crude reserves would have given the petroleum industry the opportunity to work out its supply problem over an extended period. Except for the war, we would probably not have heard much about an impending crude shortage at this time. It is the necessity for providing the Allied forces with petroleum for a global war that has aggravated the situation.[6] Before attempting to

CRUDE OIL PRODUCTION, IMPORT AND EXPORT

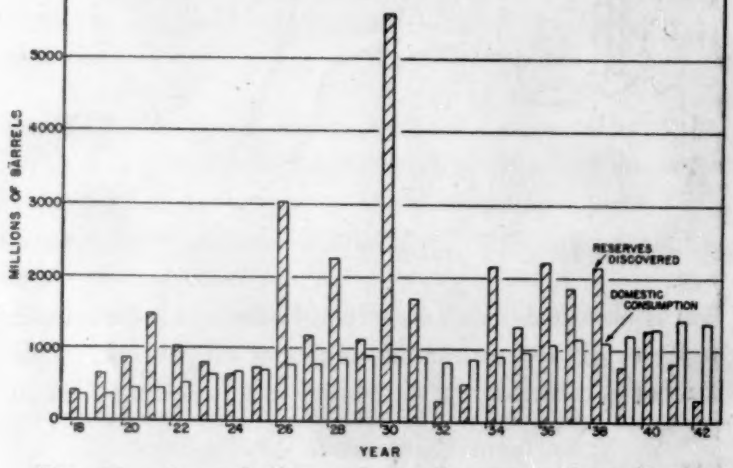

FIG. 11. Annual discoveries and consumption of petroleum, according to Heroy.[6]

explain why this is so, it may be well to see what is involved in the war requirements.

In a recent report by W. R. Boyd, Jr., chairman of the Petroleum Industry War Council, mention is made of "the tremendous military demands for petroleum, which because of censorship have not been revealed to the oil industry, and already, exclusive of huge amounts of aviation gasoline and lubricants, are equivalent to about 25 per cent. of the total current production of crude oil in the United States. This demand has an even greater effect because the manufacture of special war products, particularly aviation gasoline, requires a disproportionate amount of the capacity for the manufacture of motor gasoline."[7] According to Petroleum Administrator Ickes, 60 per cent. (or nearly two out of every three tons) of the supplies sent overseas to our expeditionary forces over distances varying from 3,000 to 10,000 miles are oil.[4]

[6] W. B. Heroy, "Supply of Crude Petroleum within U. S.," statement in connection with Bill S. 1243, July 29, 1943.

[7] H. D. Ralph, *Oil and Gas Jour.*, July 22, 10, 1943.

Using President Roosevelt's figure of 1,110 gallons of fuel per bomber, a thousand-plane raid in the European theater of war consumes more than a million gallons of aviation fuel, or the equivalent of about one third of the cargo carried by a modern tanker. The situation is aptly described in Premier Stalin's toast at the time of Prime Minister Churchill's visit to Russia: "This is a war of engines and octanes. I drink to the American auto industry and the American oil industry." Or as Ickes has expressed it, ". . . the side than can throw the most oil into the fray over the longest period of time will win."[4]

To meet these requirements, the United States is now producing crude oil at the rate of more than 4,200,000 barrels a day. To illustrate what this figure means, we may observe in passing that it represents well over four times the production during the height of the World War in 1918. Only four to five days' production at that rate is needed to equal the annual prewar consumption of petroleum and related products in the whole of the Italian Empire with its population of 45,000,000.[8,9] Less than ten days are required to equal the most recently estimated yearly production of crude in Rumania, which is the chief supplier of petroleum to the Axis powers.[10]

Large as current production is, it may at first sight appear strange that there is much of a drain on the reserves of some 20 billion barrels known to be in the ground. The explanation is that a "rate of withdrawal" factor is involved. To understand this problem fully, we must remember that crude oil occurs in the ground in porous rock, the permeability of which governs the physical rate at which the oil can be withdrawn. Also, oil contains no inherent energy, and it must therefore be displaced from the reservoir rock either by expanding gas associated with it or by water. In dealing with such a heterogeneous system, the efficiency with which the oil is displaced improves with reduced rate of withdrawal. Conversely, high rates of withdrawal result in inefficient flushing of the oil from the reservoir rock and consequent reduction in recovery. This imposes certain restrictions on the country's capacity for producing petroleum.

In other words, there is no immediate shortage of oil known to be in the ground. The problem confronting us is rather one of being able to withdraw this oil at the desired rate. In some fields, which are being operated on the best engineering principles, the natural gas is pumped back into the ground to aid in

[8] *Oil and Gas Jour.*, July 28, 86, 1943.

[9] *Oil and Gas Journal* (*l. c.*) gives the prewar petroleum requirements of Italy as less than 40,000 barrels daily; "Petroleum Facts and Figures" (13, page 18) mentions a somewhat higher figure of 21 million barrels a year as the Italian consumption in 1938 of petroleum and related products (motor benzol, alcohol, and synthetic fuels).

[10] *Ibid.*, August 5, 14, 1943.

ringing still more oil to the surface; but in many der fields all or most of the gas has been withdrawn, aving an inordinately high percentage of the original l to be taken out of the ground by secondary recov- ry methods.

Next comes the question of oil not yet discovered. t is difficult for any one to make a reliable estimate f the possible hidden reserves of crude. The view- oint of the petroleum geologist is presented by Pratt,[5] who discusses the prospects of finding oil in erms of the subterranean structures and the efforts o explore these structures for their oil deposits. Of he crude so far discovered and developed world-wide, ome 54 per cent. is accounted for by the search within he United States (Alaska not included). While this country constitutes only 5 per cent. of the land area of the earth, it contains 15 per cent. of the structural rea most favorable for the occurrence of oil fields. If exploration by drilling is extended over this total rea and if per acre yields equal to the average of the lready proved areas are assumed, it would appear hat the United States ultimately should give up at least 100 billion barrels of oil, including the 46 billion barrels which represent the total discovery (production plus reserves) to date. On the same basis, the rest of the world would ultimately produce some 600 billion barrels of oil, including the 38 billion barrels already found. Such considerations lead to the conclusion that "at the present rate of consumption the probable ultimate oil resources of the earth, made available and freely distributed, should meet humanity's needs for 300 years to come."

How to locate these potential oil reserves is a problem with so many technical and emonomic aspects that an adequate discussion can not be undertaken as part of this brief review. Not even those best qualified to have an opinion of this subject can predict how long new oil will continue to be brought in at the rate it is needed. This is the situation which has aroused so much recent comment and which logically leads to the question of where we stand with respect to alternate sources for the products now being obtained from petroleum.

(To be concluded)

OBITUARY

BARBARA STODDARD BURKS

THE death on May 24, 1943, of Dr. Barbara Stoddard Burks brought to a close the short career of a clear-visioned investigator who did much to emphasize the close relationship between the fields of psychology and genetics. Born in New York City in 1902, Dr. Burks received the A.B. and Ph.D. at Stanford University and was early identified with the psychological research in progress in California. In collaboration with Dr. Lewis M. Terman, she made a study of school children of outstanding intelligence, following their development through adolescence and finding them still superior in intelligence and achievement in later years. During her years in California, she began an extensive study of the children of parents with readily recognizable traits, such as alcoholism, comparing the development of those children reared by their own parents with those placed with foster parents. The results of this study helped to clarify the role of heredity in psychological development, while revealing the complexities of the situation. She made also a thorough and painstaking analysis of the intelligence, temperament and social adjustment of identical twins reared apart, following a number of such twins through many years of development, and concluding that heredity is of fundamental importance in determining the mental ability and temperament of the individual, while environmental differences play an important role in social adjustment. A well-trained and capable mathematician, Dr. Burks applied precise statistical criteria to her analyses.

In 1934, after the death of her husband, Dr. Burks went to Europe as a fellow of the General Education Board, and upon her return in 1936, she became a research associate at the Eugenics Record Office of the Carnegie Institution of Washington at Cold Spring Harbor, New York. Here she pursued for four years her interest in genetics in relation to physical and mental traits. She studied the inheritance and linkage of several mutations in man (ovoid red blood corpuscles, mid-digital hair and missing lateral incisors) and sought to establish a case of autosomal linkage. She also continued her studies of identical twins reared apart, making frequent trips across the continent to interview and test her cases. The high regard in which she was held by geneticists was evidenced by her appointment as chairman of a section meeting, that on abnormal human characters, at the Seventh International Congress of Genetics at Edinburgh in 1939, only one other woman, Dr. Kristine Bonnevie, being so honored.

In 1940, Dr. Burks became a research associate at Columbia University, collaborating with the State Charities Aid Association and the Social Science Research Council in a continuation of her foster-child studies. This work, left unfinished at her death, is being carried forward by Dr. Anne Roe. Dr. Burks was awarded a Guggenheim fellowship for the year 1943–44 for an extension of her study of identical twins, but her death occurred before the tenure of the fellowship began.

Dr. Burks was keenly interested in social problems

and felt strongly the responsibility of the psychologist and geneticist in this respect. Her home was a center for thoughtful and constructive discussion of social issues by her scientific friends. She spent a vast amount of time and energy as chairman of the Committee on Aiding Displaced Foreign Psychologists of the American Psychological Association, and through her efforts many exiled scholars were placed in academic positions. She served also as editor of the *Bulletin* of the Society for the Psychological Study of Social Issues. She was an astute critic of scientific and social literature, and her lively book reviews were a constant source of enjoyment to her readers.

The pioneering work of Dr. Burks in demonstrating the relation between genetic characters and psychological traits, and in the application of advanced mathematical method to the analysis of psychological data established her as a scientist of high caliber, whose future contributions to her field of research were certain to be of great value had her life not ended so soon. To her colleagues and friends, her contagious enthusiasm for scientific investigation, her refreshing open-mindedness to the ideas of others, her genuine interest in those around her and the warmth of her friendship are irreplaceable.

KATHERINE S. BREHME

WELLESLEY COLLEGE

FREDERICK JOSEPH TAUSSIG

THE sudden death from pneumonia of Dr. Frederick J. Taussig on August 21, 1943, was felt in a keenly personal way by many people in different walks of life. They could scarcely believe the news because he had so recently, and in such high spirits, left for a well-earned vacation at Bar Harbor. Now it is realized, as never before, how much he has been giving to St. Louis and to the nation in kindly, unobstrusive but very direct ways.

Not only has he ushered into the world two generations of St. Louisans (1902–43), but these fortunate ones and their parents have enjoyed the feeling that he was their friend, always interested in them and ready to help whenever the occasion offered.

In Washington University School of Medicine, from which he graduated, in 1898, class after class of students has profited by his teaching for well over 30 years. Through these enthusiastic disciples his influence for good has spread far and wide.

A frequently mentioned characteristic of Dr. Taussig was his boundless energy. Teaching, and a large practice, of the kind in which he was called into service at all hours of the day and night, he took in his stride, ever cheerful, never apparently unduly hurried.

By some miracle, he also found time to direct the medical activities of two great institutions, the Barnard Free Skin and Cancer Hospital in St. Louis and the State Cancer Hospital at Columbia. His directness, understanding of human nature and sense of humor made an almost unbeatable combination.

Numerous publications bear witness to his wisdom and industry, of which, perhaps, the most significant is his book, "Abortion, Spontaneous and Induced, Medical and Social Aspects," a classic recognized everywhere by medical men and sociologists alike.

Dr. Taussig communicated his zeal for research to others. An effective way promptly to bring a conference with most scientists to a close is to speak about one's own work, not theirs. Not so with him. He was always interested in every serious effort to advance knowledge. The secret of the marvelous manner in which Dr. Taussig remained so characteristically young to the last may have been his quick forgetfulness of self and the resolute way in which he looked ever to the future.

E. V. COWDRY

WASHINGTON UNIVERSITY SCHOOL OF MEDICINE

RECENT DEATHS

A CORRESPONDENT writes: "Professor Oscar M. Morris, professor of horticulture and horticulturist in the Agricultural Experiment Stations of the State College of Washington, recognized as a national authority in the field of pomology, died at his desk on November 13 at the age of sixty-nine years. He joined the staff of the State College of Washington in 1910, and was head of the department of horticulture from 1911 to 1927. He began collegiate teaching on the staff of his alma mater, Oklahoma Agricultural and Mechanical College, in 1898, and was advanced there to a professorship of horticulture and horticulturist. He was a member of the American Pomological Society, the American Society for Horticultural Science, Phi Kappa Phi and Alpha Zeta."

THE death at the age of seventy-six years is announced of Alfred Vivian, emeritus dean of agriculture of the Ohio State University.

DR. E. P. CLARK, for the past fourteen years senior organic chemist in the Division of Insecticide Investigations of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, died on November 7.

JOHN W. STACEY, research associate in botany in the California Academy of Sciences, a well-known distributor and publisher of books on biology and medicine, died in San Francisco on October 16 at the age of seventy-two years.

SIR EDWARD BAGNALL POULTON, until his retirement

1933 Hope professor of zoology at the University Oxford, died on November 21 at the age of eighty-ven years.

ACCORDING to a Reuter message from New Delhi, Sir Aurel Stein, the Asiatic explorer, died on October 26 at the age of eighty-one years.

SCIENTIFIC EVENTS

BRITISH VITAL STATISTICS

IN the foreword to the Summary Report of his department for the year ended March 31, Ernest Brown, British Minister of Health, states that in many ways the year was a notable one, remarkable, among other things, for a series of favorable records in vital statistics, and for an increase at the same time in short-term sickness. He writes:

> There can be no doubt that the nation's prodigious war effort has imposed a severe strain upon the health of the people—a strain which they have in general withstood with dogged determination and astonishing success. So far as we can, we have made ready to meet any attack that disease may make. . . . But, as has often been emphasized, the strains of war are progressive, and their effects on health may be long-term. Certainly in the fifth winter of war, we must not relax our watchfulness or reduce our activity.

The report, according to *The Times*, London, states that the year was a record-breaking one in vital statistics, apart from the black spots in venereal disease and tuberculosis. Maternal and infant mortality rates and the standardized death rates among civilians, male and female, were the lowest ever recorded in England and Wales, and the incidence of infectious diseases was remarkably low, probably the best on record. Inquiries among doctors and rising claims to sickness benefit under the national health insurance scheme suggested a considerable increase in short-term sickness, but an increase in minor ailments might well be expected after more than three years of war.

Deaths in England and Wales in 1942, including registered non-civilian deaths and those due to enemy action, numbered 480,137, or 55,043 less than in 1941, the general death-rate among civilians being remarkably low. Among females the standardized rate was 6.84 per 1,000 living, or 8 per cent. better than in any previous year, notwithstanding the inclusion of deaths in this country from enemy action and the withdrawal of large numbers of healthy young women from the civilian population. Among civilian males the standardized rate of 9.52 was also the lowest recorded, in spite of the considerable effect of selective recruitment. Mortality of children at the pre-school ages of one to five, which had declined by no less than 47 per cent. between 1931–35 and 1939, showed a further improvement of two per cent. in 1942; and at the school ages of five to 15 the low level reached in 1939 was regained.

Live births, 654,039, increased by 66,811, and, after allowing for deaths, there was a natural increase of 173,902, the rate of 15.8 per 1,000 being the highest since 1931.

The report points out that the number of houses repaired up to March 31 was 2,500,000, and well over 1,000,000 had received more extensive repairs. The housing position, however, is serious, and "a vast amount of work is required to bring housing conditions up even to the standard of 1939, a standard by no means as high as that aimed at before the war broke out."

THE HOOKER SCIENTIFIC LIBRARY

A BRANCH of the Hooker Scientific Library was opened on November 1, 1942, at Wayne University, Detroit, by Dr. Neil E. Gordon, chairman of the department of chemistry. The object of this branch is to help the library to continue the service which was started at Central College in October, 1939. The demand for translations, searches, abstracting and photocopying became so large that a plan was formulated to develop in Detroit a complete modern chemical library. The sum of $200,000 has been raised by subscription from foundations, chemical industries and individuals, $100,000 to be used for the purchase of the library and $100,000 for modernizing and adding to it.

Contributions are conditional upon the acceptance of the following responsibilities by Wayne University—maintenance and development of the collection; a staff sufficient to make the library useful to chemists; space for housing and service; and maintenance of a chemical technology service covering translations in fifteen languages, searches, consultation and photoreproduction.

Dr. Gordon announces that the acquisition of the library for Wayne University has been assured by a grant of $100,000 toward its purchase by the Kresge Foundation. The other $100,000 is being contributed by the American Association for the Advancement of Science, the local section of the American Chemical Society, the Barnes, Gibson and Raymond, Burroughs Adding Machine Company, the Chrysler Corporation, Carboloy Company, Inc., Difco Laboratories, Inc., the Detroit Edison Company, the Ethyl Corporation, Eberbach and Company, the Federal Mogul Corporation, the Gelatin Products Company, the General Motors Corporation, the Hercules Powder Company, Mrs. Icie Macy Hoobler, Dr. and Mrs. Sibley Hoobler, the McLouth Steel Corporation, the Miner Estate,

R. E. Marce, the Murray Corporation of America, the Neilson Chemical Company, Parke, Davis and Company, Wyandotte Chemical Company, the W. R. Warner Company, the White Star Gasoline, the U. S. Rubber Company and the Udylite Corporation.

There will be connected with the library courses for the training of specialists in chemical literature. Candidates for this training will be encouraged to enter the graduate school for advanced degrees. The library will be known as the Kresge-Hooker Scientific Library.

THE AMERICAN ORNITHOLOGISTS' UNION

THE sixty-first annual meeting of the American Ornithologists' Union was held at the American Museum of Natural History, New York City, on October 20.

Due to travel restrictions, the usual five-day meeting with program sessions was dispensed with, all activities being condensed into a streamlined one-day business session to meet requirements of the by-laws and incorporation rules. Fifteen members of the council, 19 fellows and 11 members were present. On Wednesday evening the group was entertained at the University Club by Dr. Leonard O. Sanford, of New Haven, Conn.

Officers elected for the new year were as follows: *President,* James L. Peters, New York City; *Vice-presidents,* George Willett, Los Angeles, and Hoyes Lloyd, Ottawa; *Secretary,* Lawrence E. Hicks, Columbus; *Treasurer,* J. Fletcher Street, Philadelphia; *Editor,* John T. Zimmer, New York City; *New Members of the Council,* Dr. Harry C. Oberholser, Cleveland; Ludlow Griscom, Boston, and Dr. Alden H. Miller, Berkeley.

The Brewster Medal Award was made to Dr. Alden H. Miller, of Berkeley, Calif., for his publication on "Speciation in the Avian Genus Junco." Two fellows were elected: Dr. S. Charles Kendeigh, Champaign, Ill., and Austin L. Rand, Ottawa.

In addition to 155 new associate members, five new members were named: Dean Amadon, New York City; Robert J. Niedrach, Denver; Frank A. Pitelka, Berkeley; Julian K. Potter, Collingswood, N. J., and Terence M. Shortt, Winnipeg.

The meeting in 1944, if conditions permit, will probably be held in New York City, in October.

LAWRENCE E. HICKS, *Secretary*

THE OHIO STATE UNIVERSITY

THE HISTORY OF SCIENCE SOCIETY

A JOINT session of the History of Science Society with the American Historical Association will be held at Barnard College, Columbia University, on December 29 and 30. The program follows:

FIRST SESSION

Dr. L. C. Karpinski, *presiding*

Conference on Latin American History

Mathematics in Latin America, a brief survey of their publications, Dr. L. C. Karpinski, president, History of Science Society, University of Michigan.

The History of Medical and Bacteriological Sciences in South America, Dr. Arístides A. Moll, secretary of the Pan American Sanitary Bureau, Washington, D. C.

Learned Societies in Latin America, Dr. Arthur P. Whitaker, University of Pennsylvania and State Department, Washington, D. C.

SECOND SESSION

Dr. Arthur P. Whitaker, *presiding*

Alexander von Humboldt as Historian of Science in Latin America, Dr. C. A. Browne, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

The Contribution of the Jesuits to the Exploration and Anthropology of South America, Dr. Alfred Metraux, anthropologist, Bureau of American Ethnology, Smithsonian Institution.

The Impact of the Fauna and Flora of the New World upon the Old World during the Sixteenth Century, Dr. Arthur S. Aiton, professor of Hispanic-American History, University of Michigan.

ALEXANDER POGO, *Secretary*

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE sixty-fourth annual meeting of the American Society of Mechanical Engineers, under the presidency of Harold V. Coes, will be held at the Hotel Pennsylvania, New York, beginning on Monday, November 29, and concluding on December 4.

The program includes about a hundred and fifty papers, addresses, panel discussions and symposia. It is built around the eighteen professional divisions of the society—applied mechanics, aviation, fuels, graphic arts, heat transfer, hydraulic management, materials handling, metals engineering, oil and gas power, petroleum, power, process industries, production engineering, railroad, textile, wood industries, rubber and plastics.

On the opening day, speakers at a luncheon on "ingenuity" will be Dr. Charles F. Kettering, director of research of the General Motors Corporation, and Dr. Vannevar Bush, director of the Office of Scientific Research and Development and president of the Carnegie Institution of Washington. An evening session on ingenuity will include papers on "The Psychological Setting for Inventiveness," by Elliott Dunlap Smith, professor of economics at Yale University; "What Our Educational Institutions Can Do for the Genius," by Dr. Henry T. Heald, president of the Illinois Institute of Technology, and "Yankee Ingenuity in Engineering," by W. L. Merrill, head of the Works

Laboratory of the General Electric Company at Schenectady.

Tuesday afternoon's program will include a session on postwar planning. The speakers will be John F. Fennelly, executive director of the Committee for Economic Development; Paul G. Hoffman, chairman of the Committee for Economic Development and president of the Studebaker Corporation, and W. C. Schroeder, assistant chief of the Fuels and Explosives Service, Bureau of Mines, Washington, D. C. The Tuesday night sessions will include a paper on "Principles of Air Cargo Design," by A. Klemin, of New York University; a symposium on "War-Time Problems of Industrial-Instrument Departments"; a production research panel on "What Most Needs to be Done in the Way of Production Research at This Time," and a panel discussion on "Accelerating Scientific Management in the Federal Government" with the following discussion leaders: Arthur S. Flemming, commissioner, U. S. Civil Service Commission; W. A. Jump, director of finance, U. S. Department of Agriculture; J. M. Juran, administrator, Office of Lend-Lease Administration; and L. A. Appley, deputy chairman and executive director, War Manpower Commission.

At the luncheon of the aviation division on Wednesday, Colonel Nathaniel F. Silsbee, U. S. A., Air Information Section of the Bureau of Public Relations, will be the principal speaker. At the dinner in the evening Harold V. Coes, president of the association, will speak on "Wartime Research and Development—A Molder of Engineering," and Ralph Damon, vice-president and general manager of the American Airlines, Inc., will give an address on "Aviation; During and After the War." The annual awards and honors will be conferred.

On Thursday, there will be luncheons of the railroad and of the textile divisions and the programs will include papers on railroad equipment in the post-war period. The evening session will include a program on biomechanics and on Friday there will be papers on textiles.

In connection with the meeting, Leo T. Crowley, Alien Property Custodian of the United States Government, has announced that an exhibit of some 45,000 copies of vested U. S. patents and patent applications will be shown and representatives of the custodian's office will be present to answer questions concerning these inventions and the licensing policy of the custodian. These patents and patent applications in the mechanical, electrical and chemical fields were formerly enemy-owned or enemy-controlled, but are now controlled by the Alien Property Custodian.

DECLARATION OF CITIZENS OF ARGENTINA

WE have received from Dr. Robert A. Lambert, associate director of the Rockefeller Foundation, a "declaration" published on October 13 and signed by a hundred and fifty eminent Argentine citizens, including South America's greatest scientist, Bernardo A. Houssay, and the government's reply dismissing all signers who held official positions. This means that the professors of physiology in the three leading medical schools, Houssay (Buenos Aires), J. T. Lewis (Rosario) and Oscar Orias (Cordoba) are out, along with a number of other distinguished university teachers.

A DECLARATION OF EFFECTIVE DEMOCRACY AND AMERICAN SOLIDARITY FORMULATED BY A GROUP OF THE COUNTRY'S REPRESENTATIVE CITIZENS

In order to express their opinion on the fundamental problems of the day and the solution which in their opinion is demanded, representative citizens of the federal capital, Rosario, Córdoba and La Plata, have resolved to sign the declaration which we herewith publish.

Among the signers figure men of outstanding action in the universities, finance, commerce, industry, journalism, letters and arts, scholastic centers and workers' syndicates, together with former ministers of state, ambassadors, legislators and heads of political parties such as the Civic Radical Union, Socialist, National Democrat, Progressive Democrat and Antipersonalist.

The document in question follows:

"We, the undersigned citizens of the present declaration, belonging to various walks of the national life, consider that at this present moment of the nation's history it is imperative and urgent to express the fundamental solution demanded by the vast majority of the people and which constitutes at the same time the basis for insuring union, peace and the future of the Argentinians.

"We sum up this resolution in the following terms: effective democracy through the faithful application of all the stipulations of the National Constitution and American solidarity through the loyal fulfilment of the international commitments signed by the representatives of the country. Argentina can not and should not apply only a part of her Constitution and live isolated or estranged from her brother peoples of America and from those of the world fighting for democracy. We also hold that the freedom of assembly and of the press—most essential within our institutional regimen—would afford opportunity for public opinion to ratify in decisive form the basic concepts here set forth.

"We deem it indispensable to further the realization of this national desire and hope that the citizens who share our aims will advise us of their adherence through any of the undersigners, believers in the motto: Effective democracy and American solidarity."

THE PRESIDENT ORDERS THE DISMISSAL OF THOSE SIGNING A MANIFESTO

THE MEASURE TOOK EFFECT ON OCTOBER 16 AND INCLUDES OFFICIALS AND TEACHERS PAID OR OTHERWISE

Buenos Aires, October 16, 1943. The Secretary of the Nation's President, Colonel Don Enrique P. González, has this day sent to the secretaries of state in the various ministries the following memorandum:

"To the Minister: On behalf of His Excellency the President, I have the honor to address Your Excellency to inform you that His Excellency has resolved that as of this day's date the signers of a manifesto which appeared in yesterday's papers, a copy of which I enclose, and which contains declarations incompatible with the honorable discharge of public duty, be declared dismissed from the national administration or any of its dependents. This decision of the government includes all those who hold public office or official positions, whether paid or honorary and of whatever nature.

"As you certainly can not fail to realize, it is not permissible for officials or employees of the state, who are obliged to set an example of respect and loyalty, to arrogate to themselves powers which conflict with administrative ethics and public morals. Nor is it acceptable that officials or employees of the state aspire to rectify, by means of collective and extraordinary declarations, a government to which they are subject and whose laws, decrees and regulations they are bound to obey. Nor can it be tolerated that they share and strengthen concepts held by militant politicians. All the above disturbs the general peace, which must be maintained at whatever cost.

"Officials and employees of the state should be fully aware of their duties, and when they forget them it is necessary to suppress the disobedience and to remind each one clearly of his position.

With my kind regards."

DISMISSALS IN THE MUNICIPALITY

The Municipal Administration yesterday issued a communication to the following effect:

In accordance with the decree of the President of the Nation, General Don Pedro Pablo Ramírez, as of this date the municipal administrator, General Don Basilio B. Pertiné, issued a decree calling for the dismissal of those municipal employees who signed the manifesto which appeared in the papers of the 15th instant and which contains declarations incompatible with the honorable discharge of public duty.

—From the Spanish
ESH, November 3, 1943

SCIENTIFIC NOTES AND NEWS

THE American section of the Society of Chemical Industry has awarded the Perkin Medal to Gaston F. DuBois, vice-president of the Monsanto Chemical Company, St. Louis, "in recognition of his outstanding work in applied chemistry." The presentation will be made at a dinner meeting of the society which will take place on January 7 at the Hotel Commodore, New York City.

DR. WILLIAM HOVGAARD, professor emeritus of naval construction at the Massachusetts Institute of Technology, received on November 12 the David W. Taylor Medal, the highest award of the Society of Naval Architects and Marine Engineers, in recognition of "outstanding achievement in naval architecture." The presentation was made at the annual dinner, which was given at the close of the two-day golden anniversary meeting of the society.

ORVILLE WRIGHT will be the guest of honor on December 17 at a dinner in Washington to commemorate the fortieth anniversary of the first successful airplane flight of the Wright brothers at Kitty Hawk, N. C. The invitation was extended by President Roosevelt at the request of an anniversary committee headed by Secretary of Commerce Jesse Jones.

PROFESSOR J. L. SYNGE, of the Ohio State University, has been awarded the Henry Marshall Tory Medal of the Royal Society of Canada "for achievement in scientific research." Dr. Synge was formerly professor of applied mathematics at the University of Toronto.

SIR HAROLD SPENCER JONES, Astronomer Royal of England, has been elected an honorary member of the American Astronomical Society.

DR. ERNEST B. BABCOCK, professor of genetics and geneticist in the Agricultural Experiment Station of the University of California at Berkeley, was appointed at a recent meeting of the Northern Branch of the Academic Senate to give the next annual faculty research lecture.

PROFESSOR GEORGE GRANGER BROWN, head of the department of chemical and metallurgical engineering of the University of Michigan, was elected president of the American Institute of Chemical Engineers at the recent Pittsburgh meeting. He succeeds J. L. Bennett, manager of chemical operations in the explosives department of the Hercules Company. Dr. L. W. Bass, director of the New England Industrial Research Foundation, Boston, formerly assistant director of the Mellon Institute, Pittsburgh, was elected vice-president.

CHESTER ALAN FULTON, president of the Southern Phosphate Corporation of Baltimore, has been elected president of the American Institute of Mining and Metallurgical Engineers. John L. Christie, of Handy and Harmon, and J. Robert Van Pelt, Jr., geologist

and technical director of the Chicago Museum of Science and Industry, have been elected vice-presidents.

THE initiation of students into the Smith Chapter of the Society of Sigma Xi took place at a dinner on November 18 at which Dr. Donald H. McLaughlin, director and vice-president of the Cerro de Pasco Copper Corporation, was the guest of honor. The following new officers of the chapter were installed: *President,* Dr. A. T. Jones; *President-elect,* Dr. A. F. Blakeslee; *Secretary,* Miss Helen Stobbe, and *Treasurer,* Dr. Elinor V. Smith. Dr. McLaughlin gave a public lecture on the Peruvian Andes, illustrated with kodachrome slides.

DR. MAXIM K. ELIAS, of the University of Nebraska, since 1939 research paleontologist of the Nebraska Geological Survey, has been promoted to a full professorship.

DR. HARLAND G. WOOD, formerly assistant research professor of bacteriology at Iowa State College, has been appointed associate professor of physiological chemistry at the University of Minnesota. He will be responsible for work on the biochemical aspects of the virus-host relationship in poliomyelitis, a research sponsored by the National Foundation for Infantile Paralysis.

DR. GEORGE FINLAY SIMMONS, from 1934 to 1943 professor of zoology at Montana State University, has been appointed assistant professor of anatomy in the School of Medicine of Loyola University at the Chicago Medical Center; he will be associated in the teaching of microscopic anatomy with Dr. R. M. Strong, head of the department of anatomy.

DR. JAMES H. CARTER, of the Iowa State College, has become professor of chemistry at Madison College, Harrisonburg, Va.

PROFESSOR A. L. MCCOMB, of the department of forestry of Iowa State College, has joined the Office of Economic Warfare, to study the development of cinchona trees in Colombia. He has been granted leave of absence for the duration of the war. Professor A. G. Norman, of the department of agronomy, also has leave of absence to enter the war research service of the National Academy of Sciences.

PROFESSOR H. T. U. SMITH, of the department of geology of the University of Kansas, has leave of absence to enable him to accept a war-service appointment in Washington, D. C., as geologist of the U. S. Geological Survey.

WILLIAM FRED DANNER, research assistant in the department of biochemistry of the University of Wisconsin, has become research assistant in the Atmospheric Nitrogen Division of the Solvay Process Company, Syracuse, N. Y.

Chemical and Engineering News states that John A. Hutcheson has been appointed director of the Westinghouse Research Laboratories at East Pittsburgh, Pa. He was formerly manager of the radio division at Baltimore.

DR. WILLIAM C. HERROLD, assistant chief of the meat inspection division of the U. S. Department of Agriculture, will retire on November 15 after thirty-five years in government service. He will become associated with the Ohio State Department of Health.

DR. GEORGE BOAS, professor of the history of philosophy at the Johns Hopkins University, has received leave of absence to accept a lieutenant commander's commission in the Naval Reserve.

CHARLES L. SAN CLEMENTE, who has been research immuno-chemist at the Institute of Pathology of the Medical School of Western Reserve University, has become a second lieutenant in the Sanitary Corps. He is stationed at Carlisle Barracks, Pennsylvania.

DR. SUMNER C. BROOKS, professor of zoology at the University of California at Berkeley, and Dr. Matilda M. Brooks, research associate in biology, have left for a lecture tour of the main university centers of South America, under the auspices of the Committee of Inter-American Artistic and Intellectual Relations.

DR. WILLIAM W. FRYE, associate professor of preventive medicine and public health in the School of Medicine of Vanderbilt University, returned early in September from a six-weeks' study of tropical diseases in Central America. The program was developed by the Association of American Medical Colleges at the request of the Surgeons General of the Army and Navy in an attempt to improve the teaching of tropical medicine in the medical schools of the United States and Canada. The program was supported financially by the John and Mary R. Markle Foundation and sponsored in Central America by the Pan American Sanitary Bureau, the Office of Coordinator of Inter-American Affairs and the United Fruit Company.

FRANK RAYNS, Norfolk County organizer of agricultural education and director of the Sprowston Experimental Station, England, will make a three-months' visit to the United States, arriving late in November. He plans to visit agricultural experiment stations and educational institutions having departments of agriculture.

SIR GERALD CAMPBELL, British Minister and special assistant to the British Ambassador, delivered on November 18 the first in this year's series of laity lectures of the New York Academy of Medicine. His lecture was entitled "The Effects of Science upon Human Beings."

THE three hundred and ninety-ninth meeting of the American Mathematical Society was held at Columbia University on October 30. An address was given by Professor W. T. Martin, of Syracuse University, entitled "Mappings by Means of Systems of Analytic Functions of Several Complex Variables." Twenty-two research papers were presented. It was voted to approve the establishment of another series of publications, entitled "Mathematical Surveys," to consist of brief but detailed expositions of certain problems or portions of fields of particular interest in current research.

THE botanical library of Dr. Charles C. Deam, of Bluffton, Ind., has been purchased by Indiana University and will soon be moved to Bloomington and housed with the Deam Herbarium, which was purchased by the university a few years ago. The library consists of about 3,500 bound volumes and numerous pamphlets and reprints, including complete sets of several periodicals and many rare works on the botany and on the history of Indiana and the Middle West.

BY the will of Mrs. Ines Stross, widow of Ludwig Stross, the sum of $121,298 is bequeathed to educational and charitable institutions. Bequests of $30,000 each were left to Columbia, Princeton and Harvard Universities. It is also directed that the residuary estate be used for educational and charitable purposes.

THE American Psychological Association has made an appropriation of $10,000 to the National Research Council for the support of the Office of Psychological Personnel for the calendar year 1944, to be expended by the treasurer according to a budget approved by the council. It is understood that any unexpended balance as of December 31, 1944, shall revert to the Psychological Association.

THE Museum of Natural History, San Diego, according to *Museum News,* has received from Mrs. Harry M. Wegeforth a collection of about 50,000 shells from all over the world, collected by the late Captain J. F. Anderson and his wife. Captain Anderson bequeathed the collection to Dr. Wegeforth, who was an officer of the San Diego Society of Natural History until his death in 1941.

THE following resolution was passed unanimously by the Conference of Southern Graduate Schools at their meeting in Atlanta on October 19: "As representatives of southern graduate schools, we wish to offer our services in the post-war program of higher education. We are equipped to provide and direct mature professional training, notably in the research necessary for the continuation of industry, government, science and education. We urge that our facilities be made available to properly prepared men and women on the same terms on which governmental aid in education may be afforded to undergraduate students. We hope that these terms will leave the student free in selecting his graduate school. We hope further that the graduate schools will be left completely free to organize and administer their courses of instruction."

A REPORT on "Scientific Research and the Universities in Post-war Britain," drawn up by a sub-committee of the Parliamentary and Scientific Committee and approved by the committee itself, according to *The Times,* London, urges a proportional expansion of the supply of scientific workers. The report points out that this in turn calls for an expansion of the universities and technical colleges and an all-round improvement in the teaching of science and scientific principles at all stages of education. The universities are recommended to prepare for a rapid growth in the number of students of science and technology, that consequently state bursaries and engineering cadetships should be continued and developed to cover the biological, medical, veterinary and agricultural sciences. The committee also proposes that university staffs, stipends and buildings should be increased, and estimates that £10,000,000 will be required for buildings and equipment spread over the first five years after the war. It is also recommended that the present annual treasury grant to the universities of approximately £2,250,000 a year should be increased to £6,000,000 or £7,000,000. To ensure the best use of the increased funds and to avoid overlapping, it is proposed that the universities should set up a suitable advisory council. Increased facilities for part-time technical study and training and greater assistance to young people already engaged in industry to enable them to take full- or part-time courses are also urged.

DISCUSSION

MENTAL MALADJUSTMENT AND COLOR VISION

THE number of cases of parachromopsia (so-called "color-blindness"), in which there is an obvious history of dietary insufficiency, especially a lack of meat in the diet, has recently suggested to us a possible relation to maladjustment of the neurotic type. We have long known that neurotic stammerers are usually non-

meat-eaters. Some of them were brought up in childhood on the vicious diet of "cereals and strained vegetables," and never acquired a taste or a tolerance for meat. Whether this could be ascribed to a protein lack, or whether there is some other feature of meat which is important for nervous stability is a question which is not important for present purposes.

We do not think that all cases of color-blindness have a dietary basis, or that there is any single condition which produces color-blindness. In fact, we know that cases of toxic origin, as through the inhalation of wood alcohol vapors from varnish over a considerable period of time, are not changed by administration of vitamin A. The similarity of the conditions in many cases of color-blindness to the conditions in many cases of maladjustment, suggested, however, that it would be well to subject persons suffering from neurotic maladjustment to test of color vision.

So far, I and my assistants have tested only twelve cases. Some of these have been under psychological treatment and some have been examined, but not treated, for various reasons. This meager list of cases is presented primarily to call attention to the possibilities; but they illustrate some of the dangerous factors involved in dependence on chart tests for color vision.

The tests used were the Ishihara and Dr. Loken's revision of the Nela test, which consists of 24 items. In the epitome below, M. indicates male, and F., female. *Ish* designates the Ishihara test, in which the charts which persons with normal color vision are supposed to read are indicated by *N*, and the charts which "normals" are supposed not to be able to read are designated by *An*. The *An* entry "partly read" means that one or more of the *An* charts were not read exactly as the color-blind are supposed to read them. We understand that such anomalies are commonly ignored by those who administer the chart tests; but our cases should make it obvious that if a chart test is to be taken seriously, even part-reading of an *An* chart by any person indicates that he should be thoroughly examined by practical tests. The epitome of cases follows.

1. M. Complex mental condition; organic trouble suspected. Sent to a physician for diagnosis.
Ish; N, all read; *An*, none read. *Nela;* six errors, but long study of a number of items finally judged correctly.
2. F. Diagnosed as epileptic; but certainly neurotic.
Ish; N, all read; *An*, all read. *Nela;* 14 errors.
3. F. Worried about going insane; other neurotic symptoms.
Ish; N, one digit wrong in one chart; *An*, none read. *Nela;* 8 errors.
4. M. Stammerer, under treatment and now approaching normal speech.
Ish; N, all read; *An*, none read. *Nela;* no errors.
5. F. Neurotic; subject to giddy spells.
Ish; N; one digit wrong in one chart; *An*, partly read. *Nela;* 4 errors.
6. M. Stammerer; not yet treated.
Ish; N; 4 charts not read; *An*, none read. *Nela;* 8 errors.
7. M. Neurotic; worrying type; family tensions.
Ish; N, one digit wrong in one chart; *An*, partly read. *Nela;* 5 errors.
8. M. Neurotic; colon ulcers; family tensions.
Ish; N, one digit wrong in one chart; *An*, partly read. *Nela;* 16 errors.
9. M. Stammerer; poor physical condition; non-meat-eater.
Ish; N, all read; *An*, partly read, *Nela;* 16 errors.
10. M. Poor physical condition; non-meat-eater.
Ish; N, one digit wrong in one chart; *An*, Partly read. *Nela;* 16 errors.
11. M. Stammerer; bad physical condition; exophoria.
Ish; N, all read; *N*, partly read. *Nela;* 7 errors.
12. M. Paranoid type; delusions.
Ish; N, all read; *An*, partly read, *Nela;* 18 wrong.

Cases 1 to 10 are of ages from 18 to 21. Cases 11 and 12 are somewhat older.

Twelve cases of course can not prove a point; but the fact that of the twelve only one is completely normal in color-vision, suggests a possibility which should receive attention through the examination of a large number of cases. Whether these cases are exceptional, or representative, is a question which can be settled only by extensive testing of maladjusted persons, whether they are classified as "neurotic," "schizophrenic" or otherwise.

We do not mean to suggest that any considerable fraction of the large class of color-blind men and women are mentally maladjusted. The possibility we have in mind is that a substantial proportion of those who are maladjusted are color-blind; which is another proposition.

Aside from the main point of interest, these twelve cases serve to illustrate a fact which we have found in the past, namely; that many persons who "pass" the chart tests are, nevertheless, parachromopsic, and many of them seriously so. If, as Murray[1] and Elder[2] contend, color discrimination is so very important for men in the armed services, the present dependence on chart tests is extremely dangerous. That color discrimination, as measured by tests which depend on the detection of similarities and differences of critical colors, fills the needs of the services is, however, open to question. The Nela test detects parachromopsia of varying degrees, but that does not indicate that it is sufficient or even necessary for selection of personnel. The chart tests, as we have earlier pointed out,[3] do

[1] SCIENCE, November 13, 1942.
[2] SCIENCE, June 18, 1943.
[3] SCIENCE, September 11, 1942.

not even test color-discrimination, since the reading of the charts depends, not on color differences, but merely on brightness differences.

For the armed services the requirement is not color-discrimination, but identification of colors, which is a different matter. Many persons who are parachromopsic have learned properly to identify significant colors. They do not see the colors as do persons of normal color vision, but the colors have the same significance for them as for those who are normal in color vision. A typical case is that of a signal man who had done his work satisfactorily, having no difficulty in identifying the flag colors, but who was eventually found to be color-blind, and was transferred from the signal corps.

The notion that color-blind drivers have more difficulty in identifying the red, yellow and green traffic lights than do drivers with normal color-vision, is without foundation. On the other hand, many persons who have normal color vision, as determined by the best tests, are quite inaccurate in their identification of colors seen singly. Some of the worst casualties in railroad history have been caused by engineers (presumably not color-blind) running through red stop signals. In less critical situations, failure properly to identify colors is not uncommon among persons who are not parachromopsic.

A further defect of all present tests of color vision is that they are administered at close range; usually at ordinary reading distance. Requirements in the service, however, are for identification of colors at varying distance; often at great distance. Distance, of course, changes the size of the retinal image, and this is a matter of importance. Image size, however, may not be the only important factor, for vision is a highly complex process. It is quite probable that the present tests for color vision, even those which really determine parachromopsia, are unsuitable for selection of personnel for the services, and that color vision should be tested under conditions similar to those in which it is to be used.

KNIGHT DUNLAP

UNIVERSITY OF CALIFORNIA
AT LOS ANGELES

THE SCIENCE MOBILIZATION BILL

AGREEING with Dr. Harlan T. Stetson (SCIENCE, October 22, 1943) that few leading men in science would not accept the five major objectives of the Science Mobilization Bill as he has presented them, I should like to express dissent from the views of the large majority which opposes the bill. I trust that I can do this without the violence and without the words unscientifically chosen, which Dr. Stetson deplores.

I am sure that Senator Kilgore does not claim perfection for his bill and that he would be quite willing to accept modifications which might be brought forth by a calm discussion.

The proponents of the bill must heartily agree with Dr. Stetson's view that the problem is not specifically scientific and technological, but social. It follows that the problem should be solved not solely by scientists and technologists, but by society—in this case by free discussion and action appropriate to our democratic procedures. Scientists must view the proposed measure as members of a social organization which is constitutionally dedicated to the promotion of the general welfare.

Apparently Dr. Stetson believes that no problem exists or that whatever problem may exist is properly taken care of by existing agencies. This is a debatable point. Investigations by Congressional committees, including the current hearings on the Science Mobilization Bill, have brought to light charges that some industrial interests have not always devoted their scientific discoveries to the general welfare. Indeed, it would seem that international cartels of various oil, chemical and drug combines have operated against the interests of the public even in time of threatened war, perilously delaying the full utilization of scientific resources in the production of military and civilian supplies. Since the press, with the exception of a few liberal journals of small circulation, has not carried news of these exposures, it is not strange that a majority of the public, including the scientists, should be unaware of the serious charges that have been made.

Two questions are pertinent to the operation of science in the United States. (1) Does our present organization of science promote the fullest advancement of scientific knowledge? (2) Does our present organization of science promote the fullest development and utilization of science for the public welfare? The two questions are interrelated. That the last two decades have brought about great advances in science in the United States can not be denied, and it would be difficult to prove to the satisfaction of all that the advances might have been greater under another type of organization. But the advancement of science does not in itself lead to the millennium. On the other hand, the social use to which science is put is a determining factor in the development of science as well as in the making of a better world. The two questions, in so far as the public interest is concerned, resolve themselves into one: Do the conditions under which science now operates permit the fullest application of scientific development to the welfare of the nation and its citizens (and since conditions may have been temporarily changed by war, one might add) in peace as well as in war?

If selfish interests are fostered at the expense of the public welfare, the question can not have an affirmative answer, and if such selfish interests are those of a minority they have no place in a democracy once they are recognized as selfish.

No doubt the problem of selfish interest is a perplexing one, and like all perplexing problems should be approached scientifically. But the possibility of "approaching it with the same order of scientific intelligence as one approaches the problems of instability in gravimetry or geomagnetism," as Dr. Stetson suggests, seems at present rather remote. It is particularly so if selfish interest is "a specific entity in human behavior inherited through evolutionary processes as a means for the preservation of the individual and the species." Must we await the same slow evolutionary processes which millions of years ago eliminated selfish interest in societies of insects and which has brought about little if any change since? Fortunately there are psychological and social means, the effectiveness of which is more immediate if less permanent than strictly biological processes. To different degrees and at different times human society has imposed restrictions on the free play of selfish interests by legal and judicial processes or by other cultural means. Selfishness is not legislated out of existence, but it may be checked with fair success. It is a social solution of a social problem, and is as scientific as the use of water to extinguish fire.

Restrictions which may be imposed by majorities on the selfish interests of smaller groups are the safeguards of a democracy. The lack of such safeguards contributed to the seizure of power in Germany by selfish interests which raised their puppet Hitler to the dictatorship. It can't happen here if an informed public opinion is alert to any threat to the general welfare.

The conclusions to which I come are nearly the same as those of Dr. Stetson—that the question resolves itself into the relative merits of no control as against centralized control, of haphazard arrangements as against organization. In this paraphrase I have avoided the words "dangers" and "compulsion" which he uses. There need be no danger so long as we have our democratic rights and privileges to prevent the usurpation of power by selfish interests; there need be no compulsion exerted on any who do not require it in the interest of public welfare.

The National Research Council has done a good job within the limitations imposed on it. It has stimulated, surveyed, promoted, served, directed attention, gathered and collated, and the men who have carried on this work are to be commended for their accomplishments. The fears of some scientists which were expressed contemporary to the creation of the council have not been justified. But it is doubtful if the council has had the power, even though willing to use it, to accomplish all the major objectives of the Science Mobilization Bill.

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DATES OF PUBLICATION OF SCIENTIFIC PAPERS

IN taxonomy, the solution of a problem often depends upon the determination of the exact dates of publication of the various papers concerned (the application of the law of priority), although in other fields the point is only of historical interest or involves only a desire to give credit where due.

It seems important to emphasize that editors should take pains to make known the actual date of appearance of the journals in their care, especially in these times when printing delays mean that the month or sometimes even the year of actual appearance does not coincide with the stated imprint date.

In one instance which I have met with, the cover and title page both state that the volume appeared on July 15, 1936, whereas I was informed by letter of November 25, 1937, that it was still being proofread. My copy actually arrived on February 18, 1938! A survey of the current periodicals in our library in my own field showed that most of the numbers are now being received from one to three months later than the date stated on the title page.

Some journals, fortunately, have made it a regular practice to insert somewhere in each issue, usually at the end, a statement of the "actual date of publication," date of mailing, date of mailing to a selected list of depositories to establish publication, date offered for sale, etc. Whatever the method, it does seem desirable for editors to consider for their journals some policy relative to making known the actual date of publication, especially for periodicals in fields where questions of priority may be involved.

CURTIS W. SABROSKY

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MORE ON "STARRING"

IT is hard to believe that Dr. C. A. Browne really believes that the situation is as bad as he indicates on page 281 of the September 24 issue of SCIENCE. I am primarily writing to answer his first question because of my position as a member of the visiting committee for the Chemistry Department of the Massachusetts Institute of Technology but with no other connection with that institution. The question is as to why the list of 82 suggestions for "starring" in the seventh edition of the Biographical Directory of "American Men of Science" includes so many from that institution. The reason is historical. In the past twenty

years the institute has lost an unusually large number of outstanding chemists. In spite of vigorous efforts it was impossible to replace these men by other men of approximately similar distinction. Consequently, two presidents of the institute have made every effort to encourage the younger members of the chemistry staff and to add to that staff young men of promise. The result of this policy has been increasingly evident in recent years. Similar factors have been at work at several of the other institutions which show large numbers of "nominations." On the other hand, many of the institutions which have no representatives or only one already have large numbers of their members "starred." Consequently, the possibility of finding a suitable member without a "star" is smaller in those institutions.

Dr. Browne is right in only one point, namely, that there is a chance of the accidental omission of the name of a deserving young scientist by the group which makes the preliminary nominations from which the "voting list" is drawn up. I have thought about this for many years and am now emboldened to make a suggestion which has been running through my mind for some time—that is, that the editors of the directory before asking for nominations from those already having "stars" in a given field write to the heads of important institutions, whether they are starred or not, asking for suggestions. To this plan could be added Dr. Browne's plan of including a certain number of scientists on the basis of what might be called their "bulk productivity" over a definite period of years. This preliminary list could be assembled and sent to the "starred" scientist with a request that he check not over twenty-five of the names and add enough nominations of his own to make a total of twenty-five indicated as his preference. Then the selection could go ahead as in the past. Another suggestion is that an additional balloting be taken so that the cutting down of the number of nominees should be made more gradually and consequently more selectively. I would insist that the final choice should be continued as at present, namely, by those already "starred." It is not possible to obtain any impersonal method which is a substitute for judgment.

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I HAVE followed with some interest the comments concerning the methods of "starring" in "American Men of Science" which have appeared recently in SCIENCE. The remarks by C. A. Browne in the September 24th issue are well taken, but it seems to me that he too has missed the crux of the problem.

I presume most scientific men use the directory for the same reasons that I, as a publisher, do—as a work of reference and information and not as a book which grades scholarship. In this connection, the remarks of the editor in the preface to the first edition concerning the process of "starring" are singularly pertinent.

It would seem that the "starring" was meant to be the basis of an original study and inquiry for the purpose of securing data for a statistical study of the conditions, performance, traits, etc., of a large group of men of science, and these results were to be included in the first edition of "American Men of Science." It is probably fortunate that they were not included. Even more, it was probably impossible to combine the two aims, which are diverse and should remain so. A volume such as "American Men of Science" should be more factual and informative than critical, more descriptive than analytical. A certain discrimination in the selection of individuals must, of course, be exercised and the editors must reserve the right to select the form of the biographical notices and what facts should be included in each biography, such as the vital statistics, education, memberships, institutional connections, and a general statement, in very brief form, of research.

"American Men of Science" should be a directory and record.

RICHARD W. FOSTER
LEA AND FEBIGER,
PHILADELPHIA

SCIENTIFIC BOOKS

ORNAMENTAL PLANTS

Diseases and Pests of Ornamental Plants. BERNARD O. DODGE and HAROLD W. RICKETT. 638 pp. Illus. The Jaques Cattell Press. 1943. $6.50.

IN the course of the past six or seven decades an extensive literature has accumulated concerning the diseases and pests of cultivated plants and forest trees. Many books in the English language, both popular and technical, relating to the enemies of certain plant groups, *e.g.*, cereals, vegetables, fruits and shade trees, are available, not to mention the hundreds of bulletins and circulars issued by various governmental agencies. Yet, despite the universal culture of flowers and other ornamental plants by homemakers and the tremendous investment involved in commercial floriculture, only a few bulletins relating specifically to the troubles of ornamental plants, and no comprehensive books in English, have been available. Ornamental horticulturists and scientists, who have long felt the need for such a book, will therefore welcome the work of Dodge and Rickett,

which, in a single volume, discusses the pests, diseases and physiological troubles affecting most of the cultivated ornamental plants.

The book is divided into two parts, part one including an elementary discussion of the symptoms associated with disease and insect injury, a description of the various disease organisms and pests producing such injury and an outline of the methods and materials used in control. Intended for the grower with little or no training in biology, this section is well illustrated by numerous line drawings and photographs which will help to carry the novice through an otherwise forbidding array of fungi, insects and unfamiliar technical terms. The chapter on control methods presents fundamental information which will be helpful to the amateur gardener. The importance of correct cultural methods and garden sanitation is given due emphasis, and many of the standard sprays, dusts and fumigants are discussed. A useful appendix summarizing the common units of measure follows the chapter on control. (Note, however, that the *common* teaspoon, which would be used by most gardeners, holds $\frac{1}{6}$, not $\frac{1}{8}$, fluid ounce.)

Part two of the book lists and discusses briefly most of the known diseases and pests of over 500 genera of ornamentals, including not only herbaceous and shrubby plants, but shade trees as well. This extensive coverage will be appreciated by grower and scientist alike since it brings together, however briefly, information scattered in hundreds of garden magazines, trade journals and scientific papers, many of which are either unavailable or are obtained only with difficulty. This section reflects the author's experience with an unusually wide variety of ornamental plants and many of the diseases and pests which affect them.

The amateur gardener will find in the book a store of information concerning the many pests which vie with him for mastery of his coveted ornamentals. He will find many suggestions which will help him to obtain the upper hand over these enemies. To the professional floriculturist and ornamental horticulturist the volume will prove useful in identifying many of the diseases and pests which reduce the profit of his operations. However, although directed primarily to the amateur and commercial grower, the book will probably find its greatest market among professional entomologists and plant pathologists who will find it a helpful reference work.

Any book of such ambitious scope, designed to meet the needs of both amateur gardener and professional grower and to be of use to the plant pathologist and entomologist as well, is bound to meet some criticism from all groups. The amateur may hesitate to invest a considerable sum in a book discussing the troubles of 500 plants when his interests might best be served by a more exhaustive treatment of the relatively few ornamentals which he cultivates and in which he is interested.

The commercial grower will in many cases find control recommendations too sketchy, and will be disappointed by the lack of information relative to many up-to-date procedures and modern materials. In discussing fumigants, for example, the authors fail to mention the use of methyl bromide, which has already come into popularity and will probably see very extensive use after the war. Likewise, naphthalene fumigation and its offshoot, Liquid Fulex fumigation, which is very widely and effectively used for the control of red spider mites on greenhouse carnations, are not discussed. Yet Campbell's Patent Sulfurizer for volatilizing sulfur, made in England, not readily available in this country and of questionable value, is described and illustrated. The carnation grower will also fail to find any mention of the dinitrophenol materials which have proved exceptionally effective for the control of red spider mites during the past three or four years. In the general discussion of mites, however, we find a paragraph discussing the reported effectiveness of phthalic glyceryl alkyl (alkyd; SCIENCE, 94: 212, 1941) resin for red spider mite control, though the use of that material appears, even to its manufacturers, altogether impractical. The commercial greenhouse rose grower will be surprised to find that, in the discussion of rose troubles, his greatest enemy, the red spider mite, is given only eight lines and that the rotenone materials are not even suggested for control.

Plant pathologists and entomologists will doubtless agree that, to them, the usefulness of the book would be greatly enhanced by the inclusion of key references to the literature pertaining to the various diseases and pests discussed and by more consistent reference to their geographical distribution. The omission of certain diseases and pests of considerable importance will be noted. While the authors discuss and illustrate the stem nematode disease of phlox, which occurs rarely in this country, the ubiquitous red spider mite and the common Verticillium wilt receive no mention as parasites affecting phlox. Nor do we find reference to mites or powdery mildew on saintpaulia, nor the stunt disease of cyclamen. The professional plant pathologist and entomologist will be puzzled and disturbed by certain control recommendations. In discussing the control of Verticillium wilt of chrysanthemums, for example, the authors suggest that "If cuttings from infested plants are desired, the plants may be treated for half an hour with water heated to 120° F., . . ." This treatment, if indeed it is effective in the control of Verticillium wilt, has not previously been reported so far as the reviewer is aware. At the same

time, the authors, while very briefly alluding to hot-water treatment for the control of leaf nematodes on chrysanthemums in their general discussion of control practices, fail to mention this experimentally tested and published method in their specific discussion of the control of chrysanthemum leaf nematodes.

To the specialist in the field covered by the book, the inaccuracies and omissions may assume an exaggerated importance, yet he will appreciate the difficulties involved in preparing a complete and up-to-date presentation in a field so wanting in critical literature. Despite its shortcomings, the book in its present form is a work for which its authors may be commended.

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RAYS

These Mysterious Rays. By ALAN L. HART, M.D. New York: Harper and Brothers. 1943.

THIS fascinating book describes some of the uses of x-ray, radium and ultra-violet radiation for diagnostic and therapeutic procedures in medicine. It is based upon the author's wide experience in the practice of radiology and his equally wide knowledge of the work of the leaders in this field of medicine.

This book is written for the layman. It describes, by simple theoretical discussions and very often by interesting examples, the apparatus and the technical procedures which the radiologist employs. The clarity of presentation is enhanced by reproductions of photographs of x-ray apparatus and of roentgenograms of several parts of the body.

It appears to the reviewer, an electrical engineer who has had the privilege of working with radiologists, that Dr. Hart has effectively and cogently described radiology for the layman, and that the layman is likely to be a more cooperative and understanding patient if he reads this book.

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REPORTS

A PROGRESS REPORT ON THE CONSTRUCTION OF POPULATION AND PHYSIOGRAPHIC MAPS FOR THE STATE OF MISSOURI[1]

A FEW years ago plans were laid to construct twin wall maps for the State of Missouri; namely, one showing the physiography, the other showing the distribution of population (1940) within the state. The project is one of compiling and of mapping data and analyzing the distribution of population in Missouri in terms of the physiography of the state. This report indicates the work already done, and the steps to be taken in the future in order to complete the project.

POPULATION MAPS

A map, scale of 1:500,000, published by the U. S. Geological Survey, has been used for the work-sheet maps. This map with rather complete drainage, rail and town patterns provides a convenient size suitable for reproduction as a wall map or even for reduction to desk-size maps.

A map of Missouri has been completed showing the variations in sizes of incorporated places according to 1940 Census data. Circles for cities were left open so that dots representing rural population near cities will show through where necessary. Nine categories of incorporated places from "Under 500" to "cities over 100,000" were set up for the classification of incorporated places. A fairly uniform distribution exists throughout the state except in the south central portion where a wider spacing exists and in the St. Louis area where the suburbs form quite a cluster.

Mimeographed forms were set up on which were tabulated total population by minor civil divisions; incorporated populations by minor civil divisions; unincorporated population for each minor civil division; and the area and density per square mile for the unincorporated population for each minor civil division. All population and area data by minor civil divisions were obtained from the Bureau of the Census. Student assistance was possible through NYA and an university research grant.

The terms "incorporated" and "unincorporated" have been used in place of "urban" and "rural" in order to recognize as many settlements as possible in addition to those listed under the census classification of "urban." In addition the plans call for an isopleth inset map of the unincorporated population. This density map will be developed on a basis showing the urban areas by size categories and the density of rural population per square mile by density categories.

PHYSIOGRAPHY MAP

The physiographic map of Missouri on the scale of 1:500,000 has been partially completed. Contours from the many topographic sheets of the state were pantographed on an interval of 100 feet. The coloring of the map, however, has been on the basis of a

[1] No illustrations accompany this considerably condensed article because the maps and tables are not ready for publication or release to the public.

200-foot interval, making it possible to choose the most significant 100-foot contour in any specific area. Approximately a third of the work of this map has been done.

For part of the Ozark area and part of the North Central portion of the state no sheets are available and airplane photographs are to be used to aid in plotting the physiography. Field work may be necessary in order to check some parts of the map. At present the project has been interrupted, but there is no doubt that an accurate physiography wall map of Missouri will be needed as much after the war as now.

SUMMARY

In addition to the two wall maps and the accompanying isopleth map of population distribution the project calls for a detailed analysis of the distribution of the population of the state in terms of the physiography. The two maps on the same scale may be published as twin wall maps in order to portray the geographic distribution of population. In a state with such variety in land forms it is hoped that a close relationship between population distribution and physiography can be brought out with great emphasis. It is hoped that this brief report will record the good intentions of the author to provide new maps useful in the field of geographic teaching and research.

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SPECIAL ARTICLES

A FURTHER INTERFERENCE IN EXPERIMENTAL POLIOMYELITIS

WE have long sought a method of demonstrating and studying the "sparing effect" or "interference phenomenon" in poliomyelitis[1,2] in cheaper animals than the monkey. Mouse experiments have failed to provide a substitute, but an equivalent has been demonstrated in hamsters using strains of virus recovered from the Battle Hill cases.[3]

Young hamsters (40–45 gms) are almost invariably paralyzed within 5 days following the intraperitoneal injection of 0.2 cc of a 10 per cent. suspension of mouse brain collected from animals infected with M-hamster virus. This strain of rodent-paralyzing virus was recovered from a fatal human case by hamster passage.[3] Susceptible animals develop flaccid paralyses of 1 or more extremities between the second and fifth days. Older hamsters are often refractory and can not be used.

If the animals have been injected intracerebrally with certain other rodent paralyzing viruses, they remain free of symptoms. The first experiments were made with McG virus, a weak strain of rodent paralyzing virus isolated in this laboratory. The intracerebral injection of 0.05 cc of a 10 per cent. suspension of mouse brain harvested from animals infected with McG virus rarely paralyzes hamsters but fully protects them against subsequent inoculation with the M-hamster strain. The protection is well developed within 6 days and persists for from 6 to 8 weeks. Armstrong's Lansing strain of mouse poliomyelitis[4] and Jungeblut and Sander's murine SK strain[5] are equally effective. Lymphocytic choriomeningitis also confers protection, as we originally demonstrated in monkeys.[1] Since the other effective viruses may all be related, the action of choriomeningitis and the time relationships are important in showing that the phenomenon is an interference rather than cross immunity.

Suspensions prepared from the brains of young, normal mice afford no protection, but the brains of older mice occasionally have done so. This is believed to imply that latent mouse encephalomyelitis virus is not infrequently present in the brains of old mice.

A suspension of pooled monkey cords, collected 4

EFFECT OF VARIOUS INTRACEREBRAL INJECTIONS ON THE RESISTANCE OF HAMSTERS TO M-HAMSTER VIRUS

Preliminary inoculum	Response	Interval (days)	Number of animals	Response to M-hamster virus	
				None	Paralysis
McG strain	none	1	2		2
" "	"	4	2		2
" "	"	7	2	2	
None			2		2
McG strain	none	6	2	2	
" "	"	26	4	4	
" "	"	34	2	2	
" "	"	47	3	2	1
None			6		6
Lansing (Armstrong)	1 paralyzed	26	4	4	
SK (murine)	All paralyzed	33	3	3	
MV monkey cord	none	21	3	2	1
None			3		3
Feces "Di"	none	7	3	3	
" (heated)	"	7	3		3
Feces "McG"	"	7	3	2	1
" (heated)	"	7	3		3
Feces "Pa"	"	7	3	1	2
" (heated)	"	7	3		3
Feces of newborn	"	7	3		3
None			6	1	5

[1] G. Dalldorf, M. Douglass and H. E. Robinson, SCIENCE, 85: 184, 1937. G. Dalldorf, *Jour. Exp. Med.*, 70: 19, 1939.

[2] C. W. Jungeblut and M. Sanders, *Jour. Exp. Med.*, 76: 127, 1942.

[3] C. W. Jungeblut and G. Dalldorf, *Am. Jour. Pub. Health*, 33: 169, 1943.

[4] C. Armstrong, *Pub. Health Rep.*, 54: 1719, 1939.

[2] Now serving in the Office of the Geographer, Department of State, Washington, D. C.

[5] C. W. Jungeblut and M. Sanders, *Jour. Exp. Med.*, 72: 407, 1940.

years ago from animals dying of MV poliomyelitis, also protected hamsters. This led to the testing of Seitz and Berkfeld "N" filtrates of 10 per cent. suspensions of feces collected from human cases of poliomyelitis. Duplicate portions of the filtrates were heated for 1 hour at 60° C. and the feces of newborn infants and presumably uninfected children were also tested. The results of representative experiments have been summarized in the accompanying table.

The procedure seems to afford a satisfactory means of investigating the interference phenomenon in poliomyelitis. The results are sufficiently definite to permit the use of small groups of inexpensive animals and the test period is relatively brief. Whether the procedure is useful in demonstrating the presence of poliomyelitis virus, as in feces where other interfering viruses probably do not occur, requires investigation.

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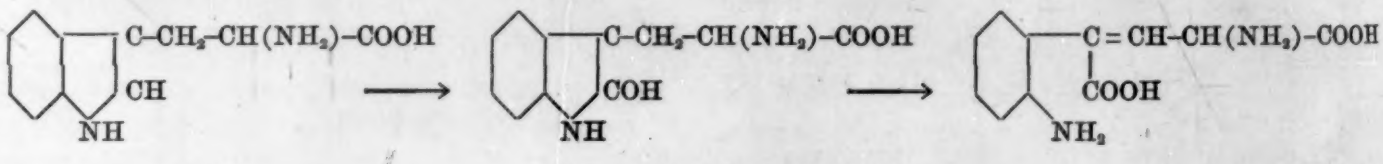
THE TRYPTOPHANE CONTENT OF a^+a^+ and aa EPHESTIA KÜHNIELLA Z.[1]

IT has been shown that in Ephestia homozygous for the gene *a* and in Drosophila homozygous for the gene *v* the lack of pigmentation of the eyes and other organs is due to lack of a specific diffusible substance necessary for the formation of these pigments.[2, 3] This substance has turned out to be kynurenin, a derivative of tryptophane.[4] The oxidation of tryptophane to kynurenin proceeds according to Kotake in the accompanying formula.



tryptophane — α–hydroxytryptophane — kynurenin

From the observation that α-hydroxytryptophane has a similar though slighter effect than kynurenin itself, it has been concluded that the genes *a* and *v* in homozygous condition inhibit the oxidation of tryptophane in the α position.[5] This is, however, not the only possible explanation for lack of kynurenin. Any mechanism breaking down tryptophane in a different way or removing kynurenin in a way so that it can not be used for the formation of pigment would have the same effects. In order to obtain evidence bearing on this question, tryptophane determinations in Ephestia homozygous for *a* and for the corresponding wild type allele a^+ have been undertaken.

Ephestia imagoes were crushed in a mortar and dried in a desiccator over concentrated H_2SO_4. After three days, the dry material was pulverized in a mortar and kept in a dessiccator in the dark until used. In some samples, males and females were kept separately, whereas in other samples specimens of both sexes were used together. Samples of these powders were extracted over night (14 to 16 hours) in 10 per cent. NaOH in a water bath at $56 \pm 2°$ C. The fluid was decanted, the solid washed once with 10 per cent. NaOH, and the washing fluid added to the first solution. The amount of tryptophane in the solution was determined with glyoxylic acid.[6] The developing color was read with an electric colorimeter. In a few instances, tryptophane was determined with p-dimethylaminobenzaldehyde after acid hydrolysis at 37° C.[7] In these cases, the color was determined with a Dubosq colorimeter. The results obtained are indicated in Table I.

In the $a^+ a^+$ animals, the males contain significantly more tryptophane than the females ($t = 4.08$, $n = 20$, $P < .01$). This is different from the findings of Demyanovskii[8] in *Bombyx mori*, where the females had consistently higher amounts of tryptophane than the males. The difference in tryptophane content between the two sexes in the *aa* race is in the same direction, but insignificant ($t = 0.58$, $n = 14$, P between .5 and .6). In all cases, the *aa* animals contain more tryptophane than the $a^+ a^+$ animals. This difference is highly significant in the samples derived from both sexes ($t = 6.07$, $n = 26$, $P < .01$) and from the females ($t = 3.59$, $n = 18$, $P < .01$), only barely significant in the males ($t = 2.58$, $n = 18$, P slightly larger than .02). The results with p-dimethylaminobenzaldehyde are less reliable than those obtained with glyoxylic acid, since the visual color determination was interfered with by the appearance of a yellow color in the $a^+ a^+$ material, which might perhaps be due to kynurenin.[9] It agrees,

[1] This work was aided by a grant-in-aid of the American Association for the Advancement of Science. The author wishes to acknowledge valuable advice given by Dr. J. H. Wilson and Dr. F. O. Zillesen of Easton.

[2] E. Caspari, *Arch. Entw. mech.*, 130: 253, 1933.

[3] G. W. Beadle and B. Ephrussi, *Genetics*, 21: 225, 1936.

[4] Rev. by B. Ephrussi, *Quart. Rev. Biol.*, 17: 327, 1942.

[5] A. Butenandt, W. Weidel and E. Becker, *Die Naturw.* 28: 447, 1941.

[6] R. J. Block and D. Bolling, "The Determination of Amino Acids." Burgess Publishing Company, Minneapolis, Minn.

[7] C. E. May and E. R. Rose, *Jour. Biol. Chem.*, 54: 213, 1922.

[8] S. Ya. Demyanovskii, Uchenye Zapiski Fakulteta Estestvoznaniya Moscov. Gosudarst. Pedagogicheskii Inst., Lab. Org. i Biol. Khim. 1938, No. 3, 89.

[9] H. Kikkawa, *Genetics*, 26, 587, 1941.

TABLE I

Genetic constitution	Sex	Per cent. tryptophane	Number of determinations	Method
a^+a^+	♂ and ♀	.233 ± .0138	15	glyoxylic acid
a^+a^+	♂	.297 ± .0074	10	glyoxylic acid
a^+a^+	♀	.206 ± .0192	12	glyoxylic acid
a^+a^+	♂ and ♀	.27	2	p-dimethylaminobenzaldehyde
aa	♂ and ♀	.409 ± .0253	13	glyoxylic acid
aa	♂	.360 ± .0240	8	glyoxylic acid
aa	♀	.335 ± .0326	8	glyoxylic acid
aa	♂ and ♀	.35	2	p-dimethylaminobenzaldehyde

however, with the determinations with glyoxylic acid in so far as in both parallel determinations more blue color was formed in the *aa* than in the a^+ a^+ samples.

It can be concluded from these determinations, that *aa* Ephestia contain more of a substance which gives the reactions characteristic of tryptophane with both glyoxylic acid and p-dimethylaminobenzaldehyde, than a^+ a^+ Ephestia. Since both reactions are supposed to be characteristic of the indole group, the results tend to support the assumption that in *aa* Ephestia the oxidation of the indole ring is inhibited.

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LAFAYETTE COLLEGE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE ANALYTICAL METHOD FOR THE DETERMINATION OF PROPYLENE AND TRIETHYLENE GLYCOL[1]

IN the course of an investigation of the bactericidal effects of propylene and triethylene glycol it became necessary to devise a rapid and accurate method for the analysis of aqueous solutions containing 50 to 100 per cent. of these substances. Since these solutions were frequently contaminated with small amounts of discoloring impurities or other organic substances, analytical methods such as the determination of the refractive index were of no value. Chemical procedures[2] adapted to the determination of small quantities (0–5 mgm) are too cumbersome and involve tedious and inaccurate dilution methods in addition to the possibility of not obtaining a representative sample.

We found that the viscosity of an aqueous solution bears a very regular and definite relationship to the quantity of glycol present in the solution. From this observation the apparatus shown in Fig. 1 was constructed. It consists of a 12-inch length of 7 mm glass tubing, the end of which had been held in a flame until the opening was closed to about 0.2 mm. Interval marks were placed 6 inches apart and 3 inches from both ends. The tube, including the marked-off interval, was surrounded by a water jacket consisting of an 8-inch length of 20 mm tubing; this was fixed by means of a cork.

To make a determination the water jacket is filled with water at 25° C. and the unknown solution, the temperature of which has previously been adjusted to 25° C., is drawn into the inner tube by means of suction on a small length of rubber tubing attached to the top. The rubber tube is then constricted, holding the column of liquid in place. When the constriction is

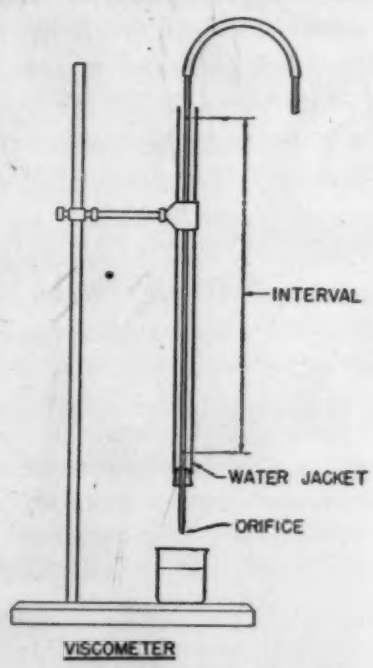

FIG. 1

released the meniscus of the liquid slowly falls. The time required for the meniscus to pass the interval marks is determined by a stop-watch.

Known solutions were carefully prepared, using volumetric methods. The concentrations of these solutions ranged from 50 to 100 per cent. glycol in water. The time required for each solution to pass through

[1] From the Northwestern Technological Institute and the Department of Medicine, Northwestern University Medical School. The work described in this paper was done under contract, recommended by the Committee on Medical Research between the Office of Scientific Research and Development and Northwestern University.

[2] T. T. Puck, SCIENCE, 95: 178, 1942.

the orifice was recorded by a stop-watch and the values charted in Fig. 2. Repeated determinations showed this method to be accurate to ± 0.001 minutes.

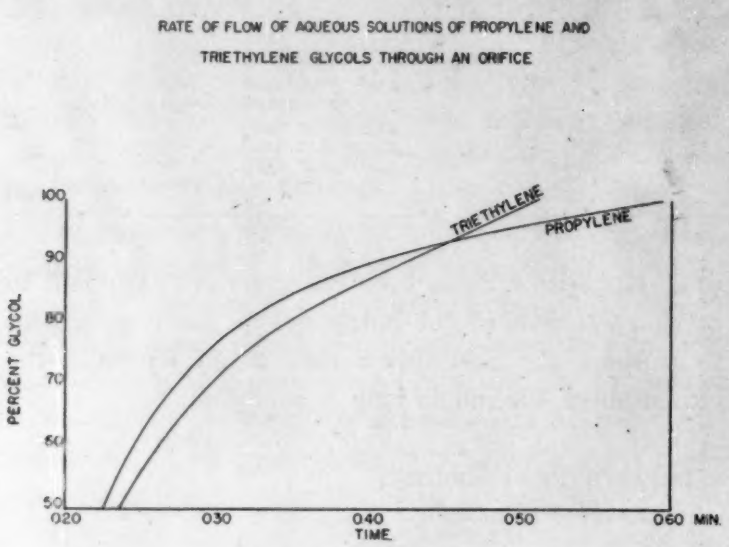

FIG. 2

Since the orifice of any given apparatus is arbitrary it would be very difficult to reproduce exactly our data. Therefore, a graph—Fig. 3—was constructed to enable the rapid calibration of any orifice. This was determined by plotting the relative viscosities of glycol to water against the known concentration of glycol. These relative viscosities were obtained by measuring the time for pure water at 25° C. to pass through our orifice and our interval. When the time required for a known series of glycol solutions to pass through any viscometer is divided by the time for water to pass through the same system the curve is obtained. Since the densities of the two liquids are practically equal they may be ignored in computing the relative viscosity. Therefore, when a new apparatus is constructed, generally having a somewhat different-sized orifice, it is only necessary to obtain the time interval using pure water. When this value for water is multiplied by the various viscosities of the glycol solution, taken from Fig. 3, a curve is easily constructed to fit the particular apparatus.

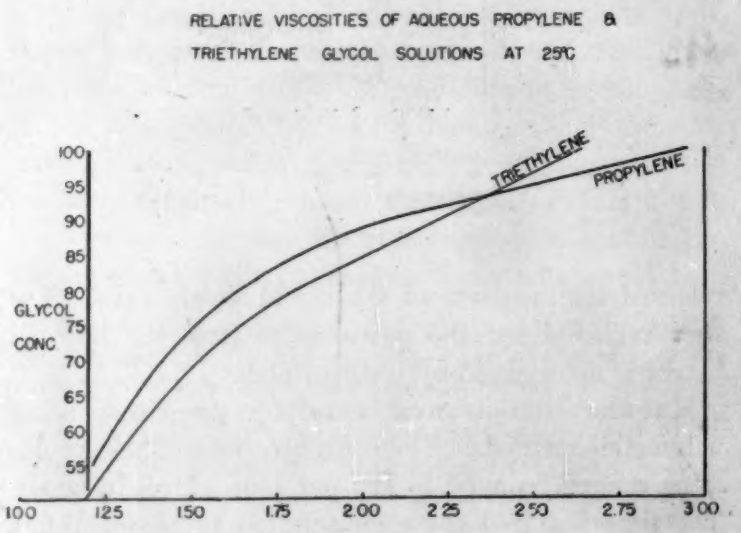

FIG. 3

CONCLUSIONS

This apparatus is easily constructed and can determine the concentration of glycol solution with an error of less than 0.5 per cent. The time required for a determination is about one minute, depending upon the size of the orifice. Using this method and the data supplied it is not necessary to measure the absolute viscosity but only the time utilized by the glycol solution in passing a given interval through an arbitrary orifice.

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A SIMPLE METHOD FOR PREPARING AQUEOUS SUSPENSIONS OF URINARY SEX HORMONE RESIDUES[1]

THE two commonly used vehicles for subcutaneous injection of urinary female sex hormone residues are oils (sesame or corn) and water. Neither is wholly satisfactory. The oils are poorly absorbed by the experimental animal and tend to encapsulate. Water is a poor solvent for the sex hormones and the inactive contaminants present in urinary residues. An aqueous suspension has been successfully employed,[2] but its preparation is rather laborious.

We wish to report a simple method for preparing an aqueous suspension of the urinary female sex hormone residue, which we have found to be entirely satisfactory.

The residue is dissolved in 2 ml of ethyl alcohol. From 0.1 to 0.2 gm (small spatulaful) of sodium alginate[3] and exactly 30 ml of water are added and the mixture is stirred on a hot plate, just short of boiling, for two or three minutes. On cooling, the suspension should have about the same viscosity as that of a heavy oil.

The success of this procedure depends upon two factors: (1) Care must be taken to add the right amount of sodium alginate, as too much will result in gel formation; a little practice soon establishes the ideal proportion to be used. (2) The stirring should begin while the water is being added in order to insure maximum dispersion of the insoluble material.

The resulting suspension is stable and shows no observable tendency to seep out at the site of injection when a No. 20, 1½ inch needle is used. The foreign material is completely absorbed and well tolerated by the spayed rat. No unfavorable reactions have occurred over a six-month period of repeated injections of our rat colony with this agent.

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[1] From the Rees-Stealy Medical Research Fund.

[2] Gustavson, R. G. et al., Am. J. Obst. & Gynec. 35: 115 (1938).

[3] Prepared and sold under the name of Kelgin by the Kelco Company, San Diego, Calif.